MAY 6 1930

ELECTRICAL WORLD

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ELECTRICAL WORLD

for the Week Ending

May 3, 1930

Roosevelt Approves 25 "Feeble Bills"

81,500,000,000 Kw.-Hr., 137 Systems

Northwest Faces Early Drought?

Passamaquoddy Tidal Scheme Revived

—ABOUT 88 per cent of the electrical energy produced in 1929 came from 137 systems. Niagara Hudson leads, New York is second and Chicago third in output.

—NEVER afraid to be different, Alex Dow defends engineering policies individual to Detroit Edison. Use is the final test, he says, and proves his point.

—OFF-PEAK house heating need be only a little more of a luxury than gas heating—or so closely controlled experiment of Public Service Company of Northern Illinois would prove. Off-peak service still the key.

—NEON CONTROVERSIES again to the fore. Washington court finds Claude patent invalid. New York dismisses $1,000,000 damage suit against President Hollingsworth.

—MERGERS and their benefits are of paramount importance, M. S. Sloan says, but public is sceptical of any but power company gains. *Ce passe.*

—HOOVER ended trade slump, in the opinion of prominent speakers at the eighteenth annual meeting of the U. S. Chamber of Commerce. But now who is going to end the present one? Words and thinking seem to be making doubtful progress against economic tides.

—LOWER RATES will mean more business. Accepted in principle, this idea is continually proving itself valid. Analysis of 43 small towns in Mississippi adds latest substantiating evidence.

—SUSQUEHANNA to have another huge hydro plant. Safe Harbor, construction now under way, will, with Holtwood and Conowingo, form one of the most concentrated and largest developments.

NEWS OF THE WEEK

Roosevelt Signs 25 Utility Bills, but Protests Their Futility

"I AM approving this large assortment of relatively unimportant utility bills in the belief that they may prove of some temporary advantage pending the adoption by a far-sighted legislature of a truly effective program," said Gov. Franklin D. Roosevelt of New York in signing 21 of the amendments to the public service commission law, sponsored by the Knight investigatory commission and passed by the Legislature.

"The failure of this whole legislative program is due to the false foundation on which it rests. The majority program, embodied in these bills, rests on the theory that the utility company lions can be charmed into lying down with the consumer lambs. The minority says that without state authority capable of curbing the carnivorous impulses of the lions the lions are more likely to lie down only with the lambs inside.

Approved bills analyzed as to purpose and effectiveness

"Many of these bills," pointed out the Governor, "are too unimportant to require mention. But three groups of four bills each warrant a brief word because they reveal how bills which carry a significant title may be enacted in a form which really represents no material gain to consumers.

"The first group (Nos. 2,290, 2,296, 2,298 and 2,328) aims to close up certain gaps in the commission's control over the acquisition of stock in the operating companies under its jurisdiction and to give legislative sanction to the commission's practice of not consenting to such acquisitions unless they are shown to be in the public interest. These bills add little to the broad authority already exercisable by the commission in this field, and, in view of the recent consolidation of the utility industry under holding companies, look very much like locking the gate after the horse has been stolen.

"The second group (Nos. 2,297, 2,299, 2,300 and 2,301) makes certain minor changes in the commission's control over the financing operations of utilities. But two of the most important recommendations of the majority, which were embodied in the original bills, were deleted in the present bills in response to protests by the utilities.

"One of these provisions, which was omitted in the final draft of these bills, would have meant a real extension in the commission's authority. It provided that a utility company must secure commission approval for all short-term loans in excess of 5 per cent of the value of its outstanding securities. According to evidence gathered by the revision commission, these short-term loans now afford the corporations a method of evading the commission's control over new construction financed by regular security issues. These short-term loans, in the leading holding company groups, are very extensive and should be brought under more effective control.

"The third group (Nos. 2,302, 2,303, 2,304 and 2,307) places the burden of proof on a corporation to justify the account in which an item is entered, if questioned by the commission at a hearing. This provision was weakened by changes before it was finally passed by the Legislature and adds little to the broad authority of the commission. The majority bills do not touch the really important extension of accounting control which would make mandatory a uniform system of accounts designed to present a clear-cut cost picture for all classifications of the various serv-

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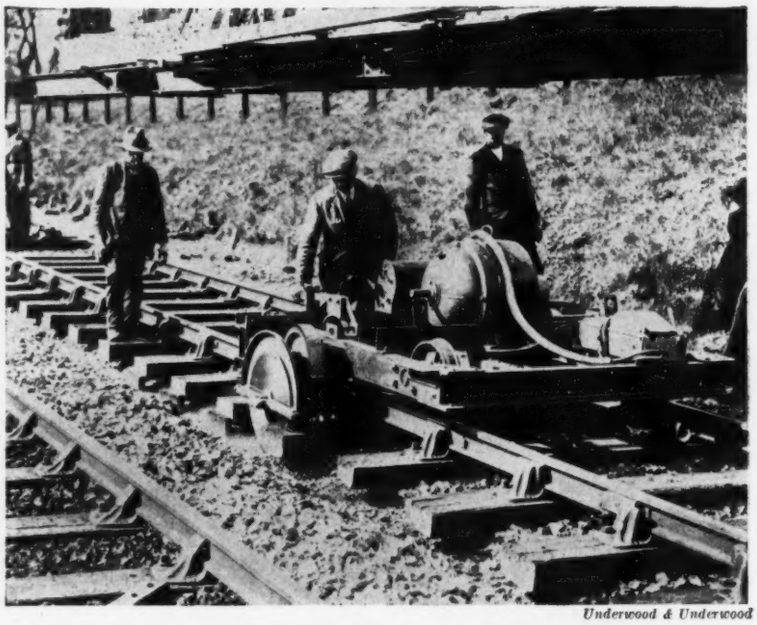
BRITAIN ELECTRIFIES MAINTENANCE



Underwood & Underwood

An electric power saw for trimming the ties of newly set track sections, speedily and economically, is but part of a recently developed British railroad maintenance machine. The overhead structure is a cantilever crane which removes track sections, rails and ties all at one time and substitutes a new unit with dispatch

Utility Reform Bills Approved by New York

Acts to amend the public service commission law in relation to

—holding companies and transactions between affiliated interests and public utility company (2295).

—disclosure of identity of persons owning substantial interests in the voting capital stock of corporations under commission jurisdiction (1675).

—judicial enforcement of rate-fixing orders (2711).

—publication and service of notice of proposed changes in rate schedules of gas and electric corporations and municipalities furnishing gas and electricity (2292).

—publication and service of notice of proposed changes in rate schedules of telegraph and telephone corporations (2308).

—control by the commission as to accounting entries of telegraph and telephone corporations (2307).

—control by the commission as to accounting entries of gas and electric corporations and municipalities furnishing gas or electricity (2303).

—control by the commission as to accounting entries of railroad corporations, and municipalities furnishing steam (2304).

—control by the commission as to accounting entries of railroad corporations, street railroad corporations and other common carriers (2302).

—the issuance and sale of stocks and other securities of gas corporations and electric corporations (2301).

—the issuance and sale of stocks and other securities of common carriers, railroad corporations and street railroad corporations (2300).

—changing the name and title of such law, and to defining a utility company and a utility corporation (1492).

—the issuance and sale of stock and other securities of steam corporations (2297).

—the issuance and sale of stock and other securities of telegraph and telephone corporations (2299).

—the acquisition and holding of the stock of telegraph and telephone corporations (2328).

—purchase and transfer of voting capital stock of gas and electric corporations (2298).

—the acquisition and holding of the stock of steam corporations (2296).

—appointment of qualified person to formulate and encourage carrying out of plan of rural electrification (1905).

—purchase and transfer of voting capital stock of railroad corporations, street railroad corporations and other common carriers (2290).

—correcting minor defects and adapting procedure to actual practice (2289).

—reparations to the user or consumer of public service, in the case of excess charges (1906).

—joint orders of the public service commission and the transit commission (1641).

—provisions affecting two or more kinds of the public service and the persons and corporations furnishing such service (1493).

—sale and transfer of property of street railroad corporations and of telephone corporations (1637).

—an appropriation for additional personal service, maintenance and operation in the department of public service (2407).

ices. Such an accounting system would serve as a basis for intelligent rate control. Under the present system the small consumer is paying more than his share of the profits."

Three other bills (Nos. 2,295, 1,657, 2,407) were accepted, under similar protest, separately. The holding company bill (2,295) and the one providing for the disclosure of the identity of persons owning substantial interests of voting stock were characterized by the Governor as "feeble" and "entirely inadequate." The third provided for the appropriation of $215,800 for additional personal service in the department of public service.

Valuation and contract measures, supposed keystones, vetoed

Veto by the Governor was the fate of the bill providing for a state-wide valuation by the Public Service Commission of public utility properties and introduced by Senator Thayer. The Governor said that the valuation bill in its final form was so entirely different from that originally submitted that Senator Thayer himself had refused to vote for it. "I am disapproving the bill," said the Governor, "because it tends simply to perpetuate the present valuation muddle, which all agree renders effective regulation impossible."

The contract bill providing for agreements between municipalities and public utility companies was also vetoed for similar reasons of inadequacy. The Governor saw "nothing novel in the present bill. It follows almost word for word the provisions of the present public service commission law relating to cost of service contracts between municipalities and street railway companies. The bill in reality leaves the present condition untouched."

The Governor approved a bill appropriating $300,000 toward the cost of a state-wide valuation of public utility properties which has been in progress for years, despite the fact that he vetoed the Knight commission bill, charging the Public Service Commission specifically with this task preparatory to fixing of rates.

Floyd Carlisle, chairman of the board Niagara Hudson Power Corporation, took issue with the Governor in an open letter regarding the data presented in Roosevelt's speech over the radio on April 23. Mr. Carlisle, after referring to important errors in estimated costs for comparable service in certain cities, wrote:

"Your statement creates the impression that the rates within the territory of our companies are much higher than those in the Province of Ontario. It is a matter of sworn testimony and exact information that in the year 1928, the latest figures available, the Hydro-Electric Commission of Ontario and its associated municipalities sold within the province 3,061,545,371 kw.-hr. and received therefor the sum of $32,431,648. The Buffalo, Niagara & Eastern Companies within the Niagara Hudson System, although generating 20 per cent of their energy by steam, that year sold 4,436,403,784 kw.-hr. and received therefor the sum of $32,911,782.

"If our companies were relieved of the payment of taxes to put them on the same basis with Ontario, they could have sold electricity to their household and farm consumers for less than one-half of the amount paid by the householders of Ontario."

▼

Passamaquoddy Power Scheme to Be Investigated

LONG-CONSIDERED plans for the harnessing of the tidal waters of Passamaquoddy and Cobscook Bays have received new support. An investigation of the possibilities of generating electric power for New England and Canada at this site is provided for by a resolution passed by the House of Representatives last week. The cooperation of Canada is essential, since Passamaquoddy Bay is bounded on the east by New Brunswick, and the resolution provides that half the estimated costs, or $45,000, shall be paid by the United States (ELECTRICAL WORLD, page 326, February 15, 1930).

The passage of the measure was urged by Representative Nelson of Maine, who told the House that the proposed hydro-electric project would provide employment for 5,000 men for four years and would make available 3,000,000,000 kw.-hr. of energy annually. He stated that the interests behind the development already have expended $350,000 in preliminary work, but that the effect of the development on the fish industry must be ascertained definitely.

President Hoover in a special message to Congress in February recommended an appropriation for a joint investigation by the two countries. Upon the result will depend the completion of the Passamaquoddy Bay hydro-electric plant by a private company.

▼

Bond & Share Hearings Continued by Commission

FURTHER evidence furnished by its own examiners was presented before the Federal Trade Commission on Wednesday in the Electric Bond & Share Company hearing. The Phoenix Utility Company was the object of fact-finding at this session. Allegedly a concern with but $2,000 of outstanding capital stock, this Bond & Share subsidiary was viewed as replete with executives, eighteen vice-presidents being charged. The accounting procedure for payroll provisions was also discussed.

Service fees paid by supervised companies to the Electric Bond & Share Company affect the rates charged to consumers, it was testified last week by John H. Bickley, accountant for the commission. The fees are charged to either operating expenses or fixed capital, and affect rates to the extent that these accounts are used as rate bases, Mr. Bickley said.

Construction fees are treated as construction costs and included in fixed capital, continued Mr. Bickley. General supervision fees, engineering fees, and auditing fees, he said, are treated as additions to fixed capital or as operating expenses, depending on their nature.

The inclusion of the fees in operating expenses affects rates, he said, because the rates must be high enough to pay expenses, and the additions to fixed capital, which is the same as cost of properties, affects rates so far as such cost is used as a rate base.

John Knox Arnold, examiner for the commission, testified on the relationship between Bond & Share and the supervised companies. He explained contracts which provided for assistance to the companies in preparing rate schedules, in financing, in developing and expanding their service, and in general matters.

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Chamber of Commerce Sees Hoover Aid Successful

THE keynote phrase, "What's Ahead for Business?" tinged the eighteenth annual meeting of the U. S. Chamber of Commerce with an air of concern. As compared with last year's event, much of the gala air had departed. Business men who gathered in Washington during the past week were ready to admit in less guarded terms than ever before that the time has come at last to think about the solution of crying problems. Three thousand members came from all branches of industry and all corners of the country.

An outstanding feature of the meeting was the enthusiastic reception of the remarks of Alexander Legge, chairman of the Federal Farm Board, some of whose policies have been criticised caustically by officials of the chamber.

Round-table conferences on April 29 developed only one resolution. It grew

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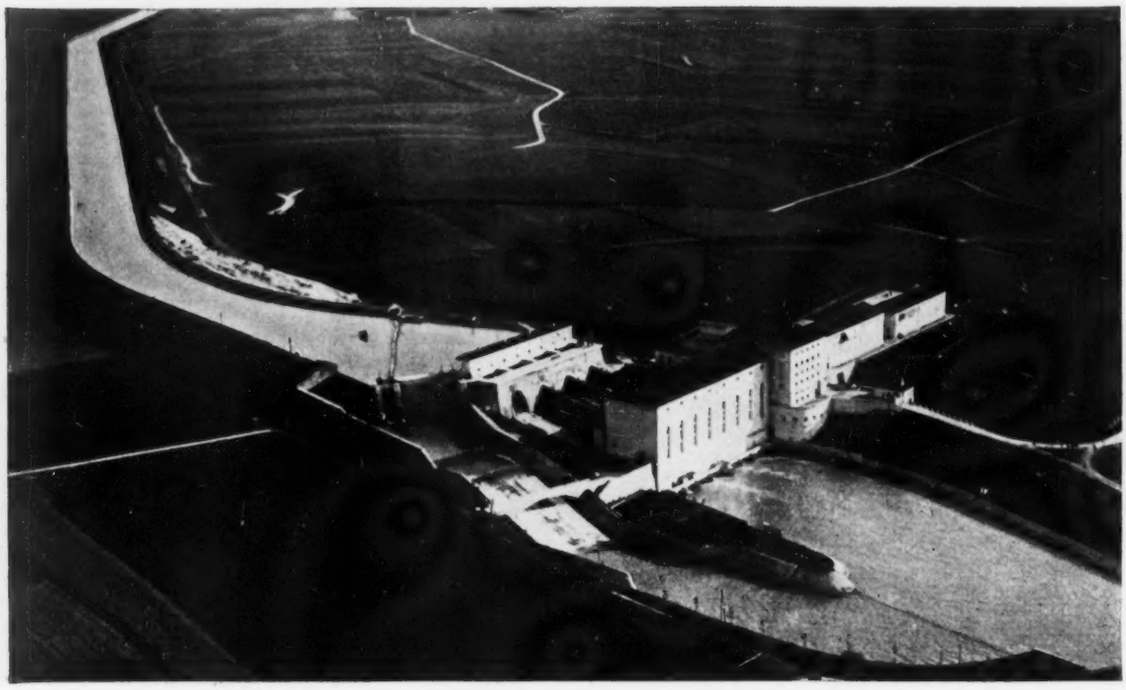
RECLAMATION PROJECT BRINGS 70,000 HP. TO BAVARIAN RAILWAYS



Eitting, one of four hydro stations using a cumulative head of 270 ft., located near Munich on the Isar River and part of the state-wide Bayernwerk scheme, develops 32,800 hp. Drainage of 40,000-50,000 acres of swamp land and equalization of flow by a large artificial lake are features. This plant operates on a 40-mile diversion canal to be used for navigation between Munich and Rhine-Main-Danube Canal

out of the discussion of natural resources industries. It reads as follows:

"*Resolved*, That the natural resources round-table recommends to the board of directors of the Chamber of Commerce of the United States that it authorize an immediate study upon which may be based a recommendation for a national policy toward reasonable conservation of natural resources, including the necessary and appropriate legislation."

Representatives of the lumber and coal industries told the group meeting that enforced curtailment of production is the only solution for their problems. Before this can be done there must be a modernizing of the anti-trust statutes, it was contended. The only alternative is the formation of huge mergers which can dominate the industry.

That President Hoover's call for the National Business Survey Conference was instrumental in shortening the depth of the business depression was expressed by Secretary Lamont and Julius H. Barnes. Both contrasted the business depression of 1921 with the current situation, showing apparent results of the effort to direct economic events.

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Boulder Dam Contracts Signed in California

THE city of Los Angeles, the Southern California Edison Company, Ltd., and other southern California power companies and the Metropolitan Water District of Southern California have signed the power contracts with the United States government which will ultimately lead to the construction of the Boulder Canyon Dam and the generating plants necessary to develop the 650,000 hp. The power contracts are drawn in accordance with the allocation agreement entered into March 20 (ELECTRICAL WORLD, page 625, March 29, 1930).

Two lease contracts, one between the city of Los Angeles and the government and one between the Edison company and the government, are combined into a single document entitled a "Contract for Lease of Power Privilege."

The federal government, represented by the Secretary of the Interior, agrees to install $21,000,000 of power generating machinery. The two lessees are obligated to pay a rental that in 50 years would amortize the cost of the machinery with interest at 4 per cent, but they agree to pay that total in ten annual payments and to keep all machinery in first-class repair and to take care of all replacements. Title to the machinery, as well as to the dam and power house structure, is to remain with the government. The government sells to the lessees only the falling water. Each lessee will operate the machinery that will be required to supply its own allocation.

Under the contract the Secretary of the Interior will appoint a director who will have general supervision over the Boulder Dam Power plant. This director will be on the government pay roll.

Lessees pay 1.63 mills for primary and 0.5 mills for secondary power

All allocations have been made on the basis of a 575-ft. dam with a firm horsepower capacity of 650,000 hp. However, plans have been put forward that will add 7 ft. to the height of the dam and 13,000 hp. to the plant's capacity, and under the contract the government reserves the right to allocate the additional power available. The rate to be paid by the two lessees, the city of Los Angeles and the Edison company, is 1.63 mills per kilowatt-hour for primary power and ½ mill for secondary power. A charge at the switchboard to allottees that are not lessees and therefore are not operating power units will be 2 mills per kilowatt-hour for primary power and 9/10 mill for secondary power.

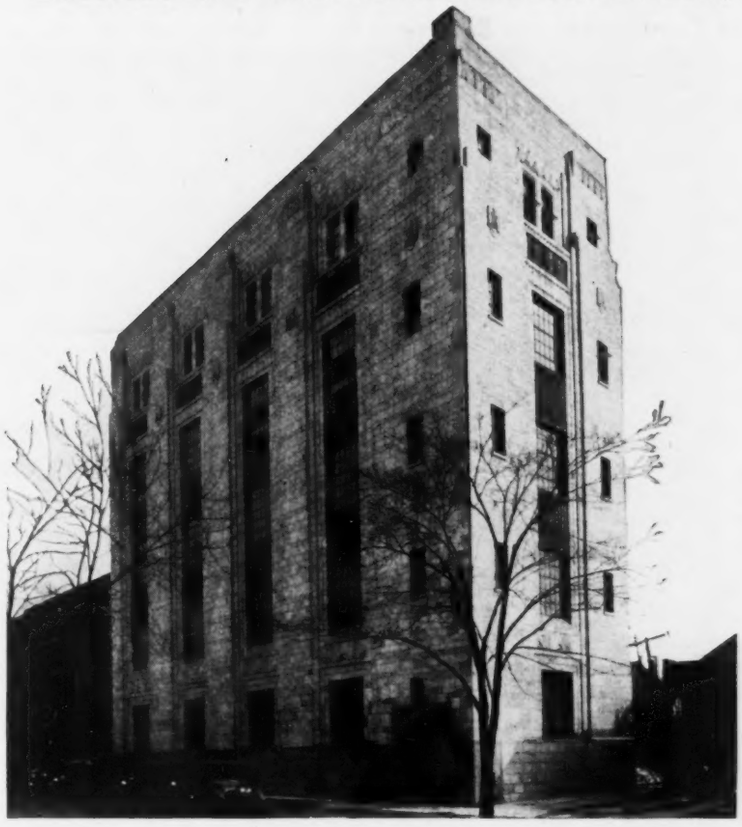
The life of the lease of the city of Los Angeles will be 50 years and will begin when dynamos capable of generating 1,250,000,000 kw.-hr. per year have been installed and are ready to operate for the delivery of energy to that city.

The Metropolitan Water District has the right to 36 per cent of Boulder Dam power under its contract, plus the first call on all secondary power, plus the first call on such of the 18 per cent allocated to Nevada and 18 per cent allocated to Arizona as those states do not use.

The city of Los Angeles gets 13 per cent. The smaller municipalities receive 6 per cent of the total power. The Edison company is lessee for 9 per cent of the total power, which amount is allocated to it, the Southern Sierras Power Company, the Los Angeles Gas & Electric Corporation, and the San Diego Consolidated Gas & Electric Company.

Of whatever power is not being used by Nevada and Arizona or by the Metropolitan Water District, the city is to have half and the Edison company half.

DETROIT HAS ANOTHER HIGH SUBSTATION



The modern tendency of substations is vertical. A recent example is the new Grand River substation of the Detroit Edison Company, where equipment of large capacity had to be installed on a small ground plot

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Safe Harbor Development Not Contingent on Bridge

DECLINING to insert a condition in the license issued the Safe Harbor Water Power Corporation (ELECTRICAL WORLD, page 625, March 29, 1930) which would require the corporation to provide a crossing over the Susquehanna River at Safe Harbor, Pa., the Federal Power Commission denied the petition of local interests. The corporation, however, has promised to provide half of the money required to finance the construction of a bridge in case a responsible toll bridge concern will provide the other half of the money needed.

The preliminary work which has been under way since last November, employing 700 men for several months, makes it possible to commence actual construction at once, according to the company. Safe Harbor is in Lancaster County, Pennsylvania, 37 miles south of Harrisburg and 33 miles above the mouth of the Susquehanna. Eight miles below the site of the new dam is the Holtwood hydro-electric development of the Pennsylvania Water & Power Company. These two plants to harness the Susquehanna near the end of its long journey to tidewater are located in the center of a heavy industrial district and will be operated as a single development. The 378,000-hp. Conowingo plant serving the Philadelphia Electric Company system is further downstream than Holtwood. Initial installation at Safe Harbor will be 231,000 hp., which will call for an investment of $30,000,000. The power house foundations are designed for an ultimate capacity of about 500,000 hp. The Safe Harbor Water Power Corporation was recently formed by the Pennsylvania Water & Power Company and the Consolidated Gas, Electric Light & Power Company of Baltimore.

Because of the spectacular interest in the construction, the Safe Harbor Water Power Corporation has set aside an elevated area for the convenience of the thousands of people who are attracted to such an enterprise. This provision serves both the purpose of aiding the visitors and the men engaged in the construction work.

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N.E.L.A. Heating School to Meet on Pacific Coast

CALIFORNIA will welcome the N.E.L.A. industrial electric heating school this year during the twelve days prior to the San Francisco convention and a comprehensive program embodying classroom work and plant inspections in the Los Angeles and San Francisco areas has been completed under the chairmanship of J. L. Faden of the National Electric Heating Committee. The school will start in the auditorium of the Los Angeles Gas & Electric Company building at 9 a.m., June 3, and at 10 a.m., June 12, it will transfer activities to the auditorium of the Pacific Gas & Electric Company's building in San Francisco. The program will include the presentation of papers by operating representatives of industrial plants in addition to the customary features. The closing date for registration in the school is May 24.

Claude Neon Patent Held Invalid by Court

THE Claude patent for a neon tube lamp has been held by the District Court for the Western District of Washington to be invalid. A life of at least 1,000 hours was necessary in the neon tube lamp in order that it might be useful, the court ruled, and then held that a tube with a pressure of 1½ mm., such as was called for in the patent, could not have this length of life. It was therefore concluded that the patent was invalid for a false teaching and because it does not describe anything useful.

The ruling of the court is contrary to the holding of the Circuit Court of Appeals for the Second Circuit and other courts that the patent is valid, it is explained in the opinion. (See also ELECTRICAL WORLD, page 901, November 21, 1929.)

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Another Hydro Shortage for Pacific Northwest?

THE acute droughts of late 1929 in the Washington-Oregon section, culminating in the assignment of the aircraft carrier *Lexington* of the United States Navy for the electrical relief of distressed Tacoma, Wash., may be encountered again.

Oregon, according to State Engineer A. B. Luper, is at this dangerously early date feeling the effects of a severe water shortage. Unless there occurs

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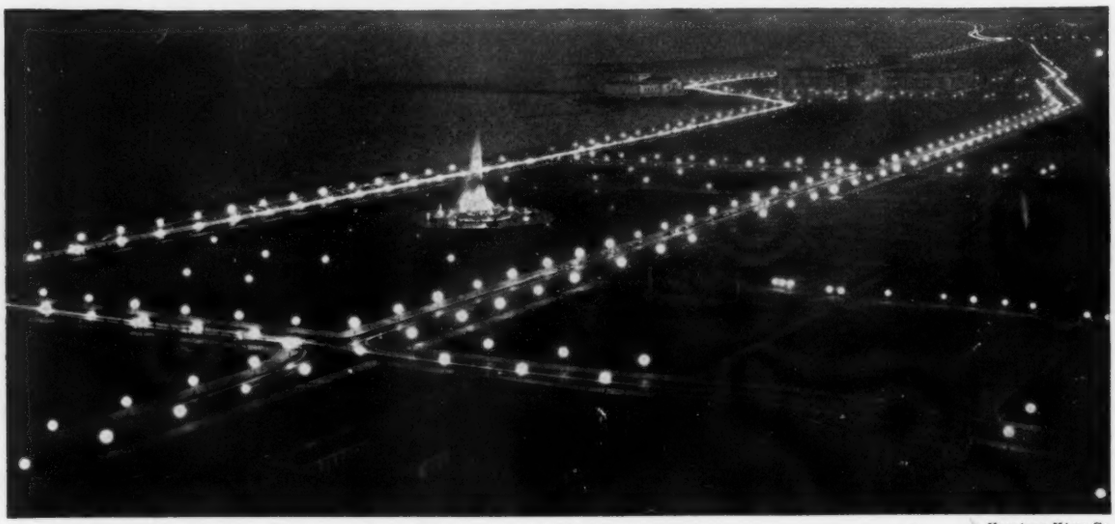
LIGHTING CHICAGO'S LAKE SHORE DRIVES AND PARK



—Keystone View Co.

Night brings an attractive vista of the inner and outer drives of Grant Park, Chicago, with the magnificent Buckingham Fountain as the central ornament

WYMAN DAM MEANS 100,000 HP. FOR KENNEBEC RIVER

Three 34,000-hp. hydro units operating under a head of 135 ft. will be installed at the $11,000,000 Wyman Dam of the Central Maine Power Company (ELECTRICAL WORLD, *page 397, August 24, 1929). The first unit will probably be ready for operation in the spring of 1931. An artificial lake, twelve miles long, impounding 2,000,000,000 cu.ft. in the top 15 ft. will be created. The dam will reach to the top of the stacks shown in this view*

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some heavy rainfall throughout this territory, states Mr. Luper, the current year will see the most serious shortage of water in the history of this state.

Although the predicted water shortage may inconvenience the operators of hydro-electric utilities in Oregon, the Public Service Commission announces that all the companies are amply equipped with stand-by plants and that no difficulties are expected in regard to the adequacy of future service.

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Maryland Commission to Quiz Potomac Edison

IN ACCORDANCE with policies set up in recent years by the Maryland Public Service Commission to establish official valuations for all the major utilities in the state, an investigation of the rates and other affairs of the Potomac Edison Company has been ordered. The company has its headquarters in Hagerstown and operates in all of the counties of western Maryland. Already all of the larger utilities in the state have been subjected to such an investigation except the Potomac Edison.

Mergers to Be Understood, Sloan Tells N. E. L. A.

"THE development and progressive usefulness of our industry in the future is largely dependent on the evolution represented by mergers and groupings," said M. S. Sloan, president of the National Electric Light Association, at the April 23-25 meeting of the Middle West Division in Des Moines, Iowa. "They are the means by which much of the price element will be extracted from the problems of electricity supply, bringing it within the financial reach of almost every person for the performance of all tasks that would otherwise be work for human hands.

"These mergers are not understood in some quarters. They are mistrusted as a scheme for setting up a power trust. Fear of a power trust has obscured all other points of consideration in many minds. The public will accept these mergers and consolidations; will approve and welcome them, in fact," continued Mr. Sloan, "just exactly as soon as it is convinced that they are in the public interest as well as our interest."

"Agriculture offers a challenge to the electrical industry," contended Kirk Fox, editor of *Successful Farming*. This challenge, and the means to answer it effectively, were discussed by K. R. MacKinnon, Nebraska Power Company, who took the rostrum for A. E. Bettis in the president's absence; in some pungent remarks of C. A. Leland, Jr., Des Moines Electric Light Company and Iowa Power & Light Company, on the utility executive's view of the rural service problem, and in other papers in the general sessions as well as in section and committee meetings. The Middle West Division is a distinctly agricultural N.E.L.A. group.

The emergence of rates into open discussion was a feature of the address by Paul Clapp. Stressing their continuously downward trends, he prophesied a maintenance of the decline in the future. The convention was well attended, more than 600 being registered. New officers of the division are: President, K. R. MacKinnon, Nebraska Power Company, Omaha, Neb.; vice-presidents, C. A. Leland, Jr., Des Moines Electric Light Company and Iowa Power & Light Company, Des Moines; W. W. Austin, Inter County Electric Company, Cottonwood Falls, Kan., and J. E. Harsh, Empire District Electric Company, Joplin, Mo.

Aluminum Company to Add More Hydro Plants

NEW links in western North Carolina's chain of hydro-electric power plants are being forged by the Nantahala Power & Light Company, a ten-million-dollar subsidiary corporation of the Aluminum Company of America. Its immediate program includes construction of the 60,000-hp. plant near Nantahala alluded to in the ELECTRICAL WORLD for August 31, 1929 (page 441), and of power lines interconnecting this plant with the company's Andrews plant and plants of the Tallassee Power Company at Santeetlah and Tapoco, as well as with the plant of the Knoxville Power Company at Calderwood, Tenn. The Tallassee Power Company and the Knoxville Power Company are also subsidiaries of the Aluminum Company of America.

Nantahala development now well under way

Principal hydraulic features of the Nantahala Power & Light Company's program, outlined by J. E. S. Thorpe, its president: (1) Construction of a dam across the Nantahala River at Lookout, near Aquone, N. C.; (2) construction of a 5.6-mile tunnel from the dam across the mountains to increase the head of water delivered at the generating plant at Beecher, near Nantahala; (3) construction of the 60,000-hp. hydro-electric plant at Beecher, and (4) construction (already nearing completion) of a 66,000-volt transmission line from the Andrews plant to the Nantahala development and from there to Santeetlah, where two 35,000-hp. power units are now in operation. Other dams are in contemplation in the Bryson City district, after the Beecher plant is completed.

Drilling of the tunnel awaits only the completion of an inclined railway. The tunnel will be 12 ft. in diameter and 5.6 miles long. The dam will be started early in 1931, Mr. Thorpe says, and will be finished simultaneously with the power house and penstocks in 1932. It will be of concrete, 185 ft. high, of arch construction with the arch against the stream, and at its crest will bridge a gorge 780 ft. in width. The construction of this dam will form a lake 8 miles long and of irregular width, capable of storing enough water to insure constant generation, even in times of drought. The head will be 950 ft. at the Beecher power house.

Other North Carolina projects planned

Future projects contemplated by the Aluminum Company of America in western North Carolina include a development at Fontana, on the Little Tennessee; a twin development of the Little Tennessee and Tuckaseegee Rivers at their juncture near Bushnell, and a third plant, mentioned now only as a possibility, on the Little Tennessee at Needmore. There are two possibilities in connection with the Fontana project. One is the construction there of a 175-ft. dam, followed by dams across the Tuckaseegee and Little Tennessee rivers, with a single power house for all three dams. The other is the construction of a high dam, possibly 425 ft., near Fontana, which would eliminate the twin-dam project at Bushnell entirely. Relative construction costs will govern the decision.

Dallas Company Plans New Generating Plant

CITY Commission of Dallas, Tex., has been asked by the Dallas Power & Light Company to approve a plan to spend an additional $8,587,000 during the next four years to provide for future expansion at Mountain Creek.

The company plans not only to build a $5,500,000 plant capable of generating 35,000 kw. but also to construct at a cost of $1,500,000 a reservoir in Mountain Creek, covering a possible 6,000-acre tract. The lake would be used not only by the new plant located there but also would serve the existing 82,000-kilowatt plant in North Dallas. The company contemplates that another $1,500,000 would be required to pay for transmission lines and other equipment.

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Triple Tandem Turbines for Powerton Station

A NEW design of turbine generator designated as the triple tandem compound type, having one electric generator and three steam turbine elements (high, intermediate and low pressure), all mounted on a single machine, is being built for the Superpower Company of Powerton, Ill., by the General Electric Company. Two of these units are now under construction for the Powerton generating station, each being rated at 105,000 kw., 1,800 r.p.m., 22,000 volts, 600 lb. steam pressure, 725 deg. F. steam pressure and boiler reheat to 750 deg. between the high and intermediate stages.

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SCIENTIFIC ADVISERS TO WESTINGHOUSE MEET

Newly created, to bring the most advanced theories before specialists of the Westinghouse Electric & Manufacturing Company, this scientific advisory board recently held its first meeting (ELECTRICAL WORLD, *page 822, April 26, 1930). Here are S. M. Kintner, director of Westinghouse laboratories; Dr. G. B. Waterhouse, metallurgy, Massachusetts Institute of Technology; Dr. Stephen Timoshenko, advanced mechanics, University of Michigan; Dr. Edward Mack, Jr., physical chemistry, Ohio State University; Dr. P. W. Bridgman, physics, Harvard, and Dr. C. E. Mendenhall, physics, University of Wisconsin*

Coming Meetings

Southwestern Division, N.E.L.A.—Hot Springs, Ark., May 6-9. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

American Institute of Electrical Engineers — District meeting, Springfield, Mass., May 7-10; summer convention, Toronto, June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 18-23. E. H. Hubert, 420 Lexington Avenue, New York.

East Central Division, N.E.L.A.—Hotel Statler, Cleveland, May 20-23. D. L. Gaskill, Greenville, Ohio.

National Electrical Credit Association—Hotel William Penn, Pittsburgh, May 22 and 23. F. P. Vose, 140 South Dearborn St., Chicago.

National Electrical Wholesalers' Association — Hot Springs, Va., May 26-30. E. Donald Tolles, 165 Broadway, New York.

American Electrochemical Society — St. Louis, May 29-31. C. G. Fink, Columbia University, New York.

North Central Division, N.E.L.A.—Managerial Section, Alex. Johnson Hotel, Rapid City, S. D., June 11-12. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Canadian Electrical Association — Manor Richelieu, Murray Bay, Que., June 11-13. H. M. Lyster, 405 Power Bldg., Montreal.

Pacific Coast Division, N.E.L.A.—San Francisco, June 16. S. H. Taylor, 447 Sutter St., San Francisco.

National Electric Light Association—San Francisco, June 16-20. A. J. Marshall, 420 Lexington Avenue, New York.

Wisconsin Utilities Association—Accounting Section, Eau Claire, June 19 and 20; Electric Section, Lorain Hotel, Madison, July 17 and 18. Commercial Section, Green Bay, July 31 and August 1. J. N. Cadby, 105 Wells St., Milwaukee.

American Electric Railway Association—San Francisco, June 21-26. Guy C. Hecker, 292 Madison Ave., New York.

American Society for Testing Materials—Haddon Hall, Atlantic City, N. J. June 23-27. C. L. Warwick, 1315 Spruce St., Philadelphia.

Association of Electragists International—Hotel Schroeder, Milwaukee, August 18-20. L. W. Davis, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Northwest Section, Bellingham, Wash., Aug. 25-27. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore.

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Two More 160,000-Kw. Generators for New York

TWO new turbo steam generators, each of 160,000-kw. capacity, will be installed in the Hudson Avenue station of the Brooklyn Edison Company during the next two years, according to Matthew S. Sloan, president of the New York Edison and affiliated electric companies. Bids have been asked for these units, which will raise the capacity of the Brooklyn station to 770,000 kw. It is estimated that the total cost of the generators, boilers and other equipment necessary will be about $14,000,000.

"When these generators are in service," stated Mr. Sloan, "the Hudson Avenue station will have a total capacity larger than the present capacity of 810,000 hp. at Hell Gate, which is now the largest steam plant in the world."

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1,500,000 Hours—All Safe —Texas Utility's Record

A PERFECT safety record for the transmission section of the power department of the Texas Power & Light Company was achieved in 1929, according to J. W. Carpenter, president of that utility company. The employees of this department, who maintain 223 substations and more than 3,500 miles of power lines, ranging in voltage from 22,000 to 132,000, worked 1,585,495 hours without a lost-time accident.

In 1928 this division showed 13,997 lost days due to accidents, two fatalities and an employee accident cost of $16,562. A definite program for safety on the part of management and men, weekly meetings, involving discussions of good practices, and full co-operation of department heads, enabled the establishment of the safety record in the year that followed.

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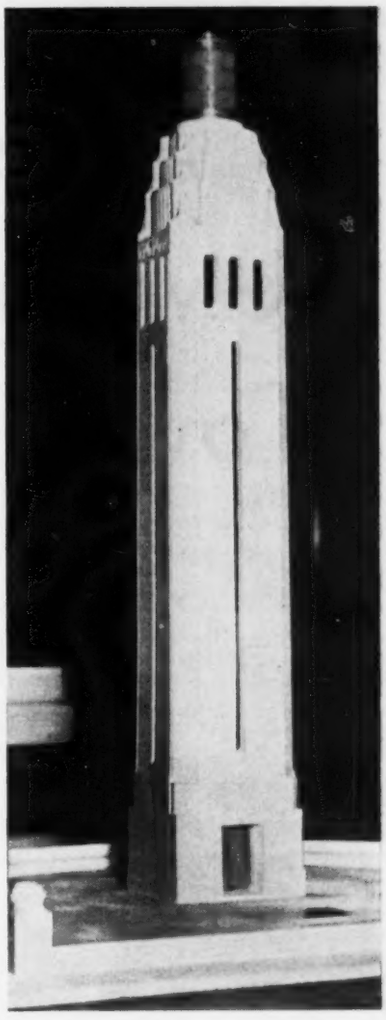
Danville, Va., Adamant Against Spirited Bidding

AN OFFER of $4,350,000 for the electric and gas utilities of Danville, Va., was made last week by the Tri-Utilities Corporation of New York, which engaged in spirited competition with the Western Power, Light & Telephone Company of Missouri. A two-hour session of the Danville City Council, with frequent recesses, assumed the proportions of an auction sale as bids were filed and frequently amended.

When the bids were opened the Western corporation offered $4,050,000, this being followed by one of $4,100,000 from the New York corporation. From these figures both concerns went constantly higher until they tied on $4,300,000, whereupon the New York concern went $50,000 higher. Collateral advantages offered by the New York concern are $100,000 in cash as a "new industries bureau" operating fund and willingness to pay $100,000 to start a new or revive some old Danville industry. The city has been receiving and rejecting offers for years. (ELECTRICAL WORLD, page 574, March 22, and page 69, January 4, 1930.) The City Council took no action, but referred the bids to the finance committee, which will make a recommendation later.

BEACON TO BE TAFT'S MEMORIAL



Cincinnati plans to honor the memory of late President William Howard Taft with a 100-ft. tower of white granite at a cost of about $40,000. An airway beacon will be the chief feature. The memorial will be in Alms Park, 1,500 ft. above and overlooking the municipal airport

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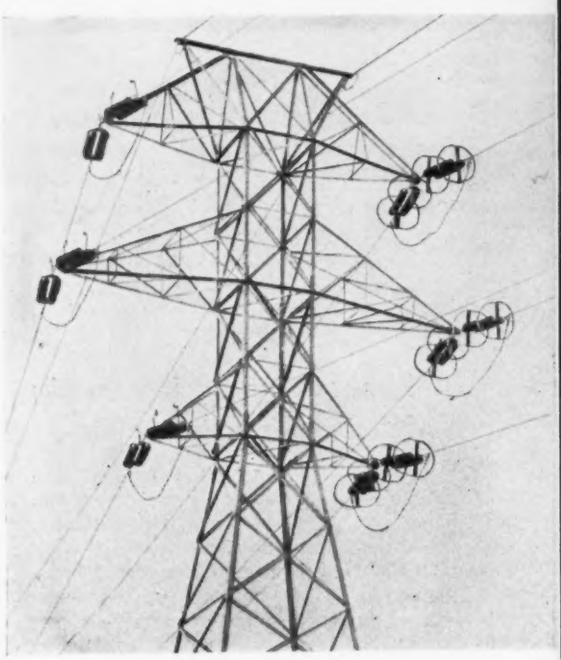
Paper Company Installs Big Plant at Hamilton, Ohio

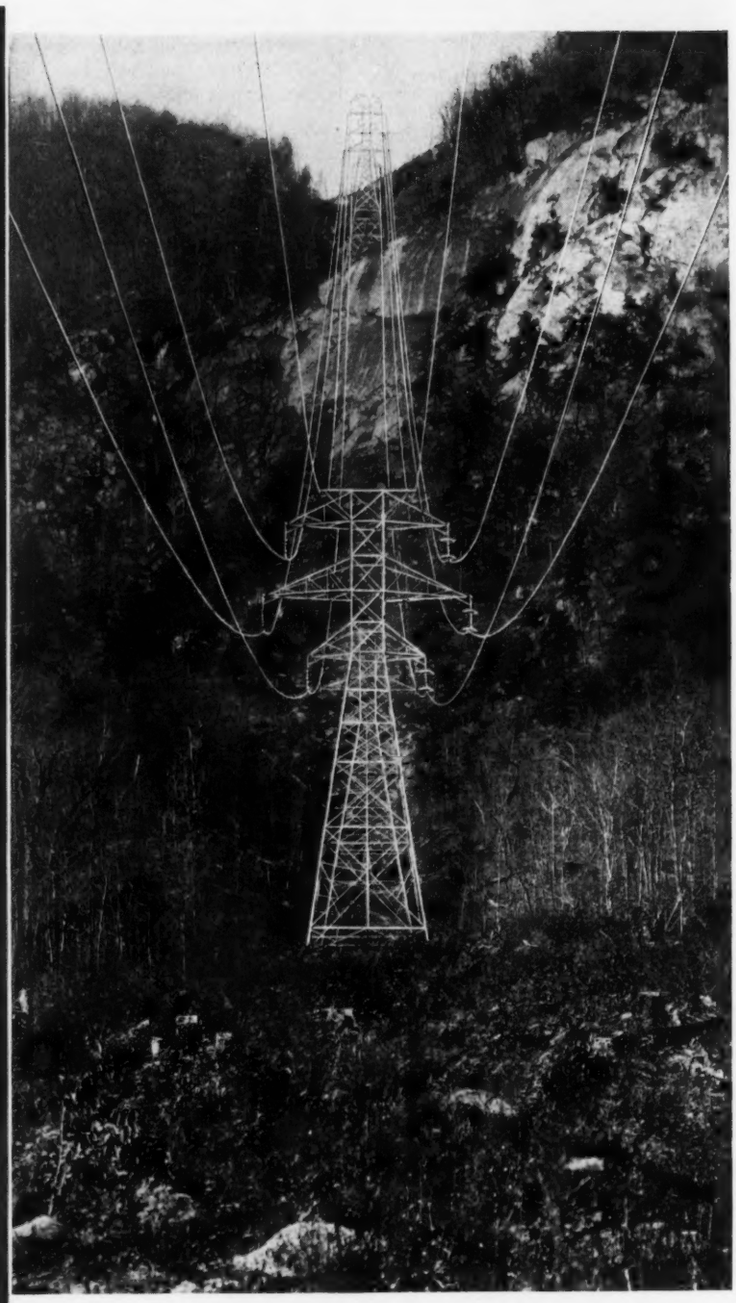
WHEELS of a new 30,000-kw. generating plant in the factory of the Champion Coated Paper Company, Hamilton, Ohio, will be turning by May 1, according to announcement of company officials. The mills are now buying some power and generating the rest in an old plant which will be held in reserve. The cost of the improvement was put at $1,000,000.

28 Miles Between Towers

IN CONSTRUCTING the new 110-kv. Canton-Greenville line of the Carolina Power & Light Company the Hoosier Engineering Company overcame many difficulties.

So impossible did the terrain prove to be in one instance that the traveling distance between adjacent towers became 28 miles. This was the situation in the hill-top to cliff-base towers shown in the larger view.





In order to secure comparative data for the relative merits of two lightning protective devices the two circuits are equipped one with arcing horns and the other with arcing ring.

EDITORIALS

L.W.W. MORROW
Editor

Meeting Power Price Comparisons

CHAIN stores and factories devote so much attention today to the analysis of operating costs in different establishments under common management that power company managers are more and more frequently being put under cross-examination, so to speak, to justify local rate differentials. In many cases, indeed, it is a recognized practice for a chain management to try to use the price of electric power in one district as a leverage to force it down elsewhere. A little difference of even one or two mills per kilowatt-hour is seized upon as evidence of discrimination, and hard bargains are looked upon as fair game in contract renewals as well as in initial agreements.

There is a growing tendency to try to carry on such negotiations from the headquarters of the chain group by mail to the local utility company's office, and these arm's-length proceedings are at times very unsatisfactory. The situation must be met with intelligence and frankness if the power company is to retain business on a basis satisfactory to such customers and itself.

Unless the utility company can cali upon some one in its organization qualified to go to the bottom in analyses of this kind it is in for trouble. *It must be prepared to give basic reasons for its power rate differentials as compared with other districts.* These are derived from many conditions, like the comparative cost of fuel in one state as against a more remote commonwealth, taxation practice, intensity of territorial development, cost of labor, cost of living, relative overheads in urban and rural regions, and many others. An efficient power sales department should be able to respond at least approximately to such inquiries from data assembled regularly in its load-building activities. Occasionally the accounting department may be called upon for aid in cost allocations, but the whole subject of competitive power conditions is such a live issue in a growing company's affairs that it should be practicable quickly to meet reasonable inquiries if the staff organization is properly planned and maintained.

It may not be easy to satisfy the chain representative as to the equity of rate differences between cities and towns in which his establishments function, but without such data the task becomes one of supreme difficulty. Armed with such information and the ability to turn the questioner's face to the mirror of his own company's varying costs in different localities, the utility man can set forth his case with a reasonable chance of success, which means the securing and retention of the customer's business on a basis fair to both parties to the power contract.

Power in Presidential Politics

LAST week in New York the Democratic party was presented with a candidate and an issue that an opportunist leader promises will make success certain in the next presidential election. Senator Wheeler nominated Governor Roosevelt of New York as the standard bearer and predicted victory if the party made an issue of the nefarious power trust.

This news is encouraging to the electrical industry. If successful in his endeavors Senator Wheeler will force into an open forum for public discussion many utility matters that have been the playthings of a few politicians. The activities of

the light and power industry will be brought into the limelight of the political campaign and the ensuing publicity about its record will redound to its credit. The incessant backbiting and nagging of a few politicians will be stopped. The facts about the industry, its accomplishments and its purposes will be made known.

Senator Wheeler has made the best suggestion to get a hearing from the public about utility affairs that could be made. We sympathize with the Democratic party if it adopts his program, but we welcome the opportunity to bring the attacks upon the light and power industry into the view of the voters of the United States, where all participants in the battle can be seen and heard. Put all possible electric power into the presidential campaign.

Legislative Spree Harmless

UTILITY regulation will never be made effective and perfect by law. The legal approach to regulation is fallacious and fails to reach into the social and economic aspects of the problem. It is encouraging to find that most of the legal panaceas for perfecting regulation embodied in the 37 bills introduced into the New York Legislature failed of acceptance. Either the Governor or the Legislature removed all the bills from the record except seven of a constructive character. These gave the commission more money, a larger staff and some increased powers.

But ideas such as a people's counsel, ten-year rate contracts, forced valuations of properties, legal definitions of value and forced procedure in rate case appeals embodied in legislation failed to become laws. Many bills were amended or were vetoed for other reasons than a sane consideration of their merits, but nevertheless they failed of acceptance. Postponement, rather than cessation, however, is all that may be said about the radical legislation proposed. At a later time these or similar proposals will be made.

Some day legislatures will realize that good regulation is based upon the fact that the utility and the state have a common purpose and that this purpose can be accomplished only by establishing and keeping harmonious relationships between the utility and the state. Both seek to improve living and industrial standards through the adoption of news ways to use electricity and the extension and intensified use of present electric services and equipments. The social and economic values in utility operation are fundamental—not the legal.

The College Graduate and His Job

THIS is the time of the year when the seniors in our engineering colleges commence to think of their jobs after graduation next June. To many this is a serious problem and one which bewilders and confuses them. The student starts his course in an engineering college often with only a vague idea about the work and opportunities pertaining to the particular field of the profession that he has chosen. During his school years he finds out that an engineer does many things of which he had not the slighest conception when he entered college. Near the close of his course he is frequently at sea, so to speak, regarding his next move. In such a case it behooves him to devote time and thought to his future and to choose his first job with care.

In the first place, he should endeavor to find out from every possible source the character of the work engineers have to perform in the various branches of the particular profession he has chosen. For instance, in electrical engineering one may consider such fields as research, design, shop management, operation or sales engineering. Each calls for a different variety of effort, temperament and training, which can be learned from interviews with practicing engineers, from executives and from their college professors.

The student must also analyze himself. He must determine his personal characteristics, his ability in the various branches of work and his natural aptitudes. This study alone may indicate a fitness for one specific branch of the profession. At the same time, he can appraise himself and determine what particular ability he can offer to a would-be employer which will incline that person in the student's favor.

In considering an opening with a company, the student should not look for the one with the highest salary or the shortest training period. He must remember that his earning power with an employer is largely determined by his replacement value. A job into which he can fit with little or no training can also be readily filled by a graduate a year hence. On the other hand, one who has to undergo several years of the hardest kind of training and hard experience can only be replaced by another who has been through the same stiff grind. The student, in fairness to himself, should master thoroughly the fundamentals of his job. Finally, no student should stop studying merely because he has left college.

Hands Across the Continent

CO-OPERATION for the good of the industry can be read as the motive between the lines of the program of the N.E.L.A. industrial heating school to be held in Los Angeles and San Francisco just before the June convention. Power company men and manufacturers' representatives on the Pacific Coast have for several years eagerly desired this school, and a fine advance registration was energetically rounded up as an inducement to Eastern and Middle Western member companies to do their part in supplying leadership and speakers.

It is a costly enterprise to spare so many key men from the electric heating branch of the industry for the time required to put through the excellent and diversified school program prepared by Chairman Faden and his associates, to say nothing of the traveling expenses and subsistence involved, but the utility and manufacturing executives of the industry have, with few exceptions, always been prompt to respond to broad opportunities for long-range load-building development.

Certainly industrial electric heating furnishes a potential load worth cultivation on a national scale, and the interchange of ideas between the East and the West, inseparable from the contacts which the heating school insures, will furnish a lasting impetus to this already remarkably successful movement.

Electric Steel Production and Acceptance

ELECTRIC melting is becoming, almost from one day to the next, a highly important factor in the production of steel castings. It is true that electric melting, on account of its possibilities of close control in analysis and extreme flexibility of operation, is most largely applied to the manufacture of special steels. But the whole business of steel founding is rapidly changing to one in which the entire output is an assemblage of products embodying special requirements. On account of competition from modern developments in the arts of steel welding and forging, the foundry has had to refine and specialize its product.

All this has made the modern steel foundry a specialty shop. A single foundry may be devoted largely to one specialty or to one class of specialties and thus simplify its processes of manufacture. But there still remain the necessities for close control of analyses and for flexibility of operation. Into these necessities the electric furnace admirably fits. Although one or two of very large capacity have been built, a single electric furnace cannot compare in quantity of output with the usual open-hearth or converter types. But this is an advantage rather than the opposite, for in it lies the operating flexibility of the electric furnace. It can handle smaller quantities of steel more quickly than can the older melting equipment.

In the usual case it costs more to melt steel electrically than in an open hearth or a converter. But against this increase of cost may be balanced the usual willingness of the buyer to pay more for electric steel. Part of this willingness is due to an appreciation of the real, tangible virtues of this metal over that produced by the older methods, but a not inconsiderable part of it derives from the connotations of the word "electric." "Electric steel" has a modern sound; it chimes in harmoniously with the conceptions of the day of electricity as the exponent of our time and the future. *There are thus two forces at work for the expansion and progress of the steel foundry industry.* One is a refinement of product that is protecting it from competition. The other is an acceptance by buyers that greatly facilitates selling the product.

The experiment was conducted in this house

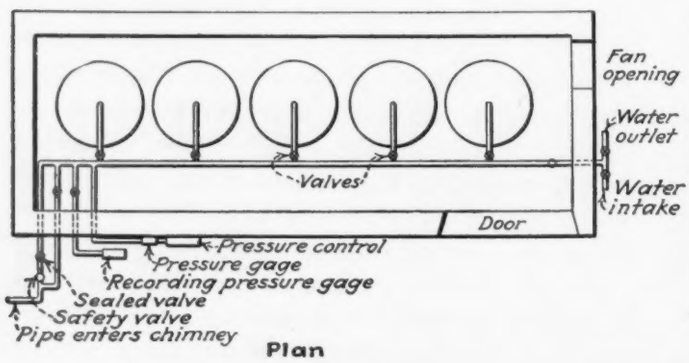
One Answer to Off-Peak

IN VIEW of developments and experiments with domestic house heating by means of storage from off-peak electric service it was considered advisable by the Public Service Company of Northern Illinois to operate an experimental installation in an average house in its territory. Such an installation was made in the fall of 1928 to obtain local experience with this type of load and to study possible effects on local distribution systems. The success of the first installation in Fort Wayne, Ind., prompted investigation of this type of load from the standpoint of off-peak revenue, possible rates for the electric service, reliability of the system and amount of business the company's generating distribution system could carry during off-peak hours.

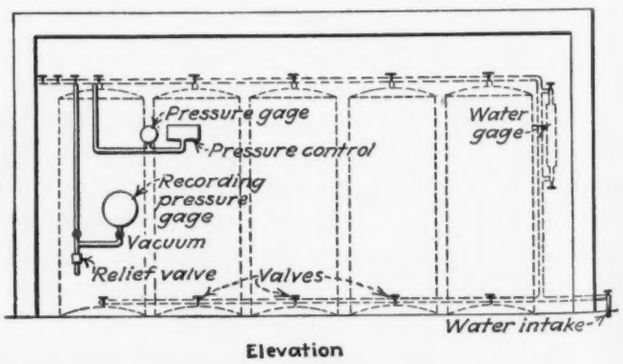
A preliminary study of available business in the territory served by the company indicated that a very small percentage of all residential customers would eventually use this type of heat at an operating cost of 20 per cent above the present cost of gas house heating. About 2 per cent of all residential customers of the Public Service Company of Northern Illinois are using gas house heating after five years of sales effort in this field, and it is doubtful if the electric house heating load would equal the gas business, or even approach it, at the above cost differential.

The Public Service Company's off-peak generating station capacity between the hours of 12 midnight and 6 a.m. indicates potential capacity for 2,500 installations similar to that in the residence of George R. Mitten, assistant to the vice-president of the company, which was selected for the experiment. But the cost difference between gas and electric heating indicates that it would be almost impossible to sell all available off-peak load capacity for this class of business even if such a degree of saturation were desirable.

The Mitten residence is located in LaGrange, Ill., is of frame construction with shingled side walls and has six rooms; its outside dimensions are 28 ft. 6 in. x 28 ft. 6 in. x 21 ft. 4 in. in height. It has $3\frac{5}{8}$ in. of insulation in exterior walls and 4 in. in ceiling, together with $\frac{1}{2}$-in. insulating board on exterior walls and ceilings. Doors and windows are weather-stripped and equipped with



Plan



Elevation

Warm air circulates through the house from a heat storage room

The heat storage room consists of a well-insulated "hot room" containing five heat storage water tanks, each of 200 gal. capacity. One tank is idle as there is ample storage capacity in four tanks. "Hot room" is 16 ft. 6 in. long by 6 ft. 3 in. wide by 7 ft. high, outside dimensions. Walls and ceiling are 8 in. thick of insulating material and sheet rock. Floor is insulated. Each storage tank is equipped with two 5-kw., 220-volt immersion type heating units. The heat storage system involves a safety valve of 53-lb. gage setting and a ball relief valve for vacuum protection.

Circulation of warm air through the house is provided by a $\frac{1}{4}$-hp., 16-in. circulating fan, located near bottom and at one end of "hot room." Fan pulls air from basement into the "hot room," circulates it around heat storage tanks and into warm air ducts leading to various rooms. House temperature is maintained at any desired point by a thermostat controlling the operations of the circulating fan in the "hot room." The thermostat is set for day temperature varying from 70 deg. to 75 deg. and for night temperature varying from 60 deg. to 65 deg.

By DELTON T. WABY

Electric Heating Engineer
Public Service Company of Northern Illinois
Chicago, Ill.

House Heating

WORTH-WHILE REVENUE can be built up in off-peak house-heating business at a rate that puts electric only a little more in the luxury class than gas heating. The scheme of storage of heat accumulated during valley load periods is perfectly workable. The load from customers willing to pay the premium for electric heat would not exceed available off-peak capacity. These are major conclusions reached by the Public Service Company of Northern Illinois in a closely controlled experiment in electric house heating which was begun in the fall of 1928 and is continuing through the present winter.

DATA OBTAINED last winter and shown in this article are being corroborated, in some cases bettered, by experience in the present heating season. The Public Service Company has made no plans to develop this class of business, nor announced any rates for it; the present installation is purely in the nature of a fact-finding experiment conducted in the home of an employee.

storm doors and storm windows. It has the average exposure and faces the west. The wall area is 1,732 sq.ft. and ceiling area 712 sq.ft. The exposed glass area is 263 sq.ft. and volume, including basement, which has been maintained at approximately room temperature throughout the past heating season, is 19,700 cu.ft.

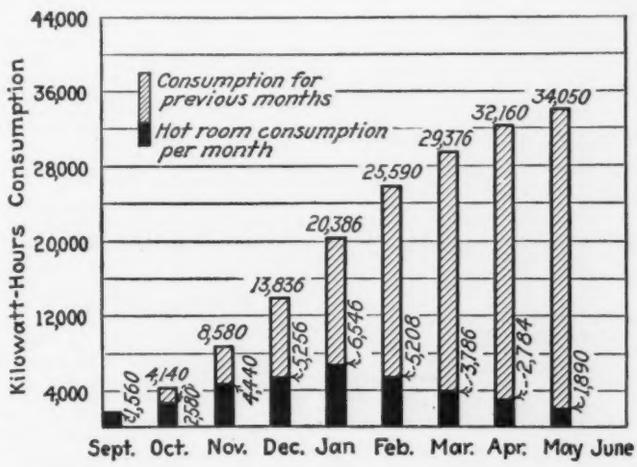
Since the experimental installation was operated on a six-hour off-peak thermal storage cycle, the sales potentiality is increased by a large percentage when longer off-peak hours and the yearly increase in off-peak capacity due to normal company expansion are considered. When valley periods of from eight to seventeen hours, as occur in some power systems, are considered, an increasing number of installations could be made before the saturation of the power company's off-peak load capacity is approached.

Results of the experiment

During the 1928-29 heating season the total consumption for heating this house was 34,050 kw.-hr., or an average energy consumption of 132.5 kw.-hr. per day, the maximum 24-hour use being 258 kw.-hr. and some days requiring no charging. Although the tanks were charged to a temperature of 282 deg. on some days, during the 1928-29 season experience has shown that sufficient heat storage could be obtained with a maximum temperature of 265 deg. F. The heat storage resulting from this temperature provides about 30 per cent reserve for the most severe weather conditions. The coldest temperatures so far experienced occurred on January 18, 1930, with a minimum temperature of 20 deg. below zero.

Variations in weather conditions during each eighteen-hour period were found to be automatically compensated for by longer or shorter charging periods during the charging cycles that followed. During the month of January, 1929, when 6,546 kw.-hr. were required, the system charged an average of 4.91 hours per day, or 82 per cent of the total possible charging time.

Following the 1928-29 season's test, an inspection was made to determine the condition of the heating system, the heating units, and their probable life. It was found



Monthly consumptions and accumulated totals for heating alone

Power Consumed Follows Temperature

	Monthly Consumption, Kilowatt-Hours		Outside Mean Temperatures, Deg. F.		
	1928	1929	1928	1929	Normal
September	1,560	1,200	61.4	64.6	65.2
October	2,580	2,940	56.5	51.1	54.0
November	4,440	4,530	42.2	36.3	40.1
December	5,256	5,400	32.2	28.6	28.8

that very little scale had been deposited on the heating units, the thickness thereon being less than $\frac{1}{16}$ in. It was evident that this scale was continually chipping off because of the rapid expansion of the heating unit at the beginning of the charging period. The terminals on the electric heating units showed no deterioration. The piping system showed no effect of contraction and expansion, and the control equipment now shows no effects of the first season's operation.

The heating system was again put into operation on September 14, 1929, to start the second season's test. From comparative figures given in the accompanying table, 1929 operations show a lower energy consumption than 1928, when differences in weather conditions are compared.

To arrive at a comparison of electricity with fuels such as gas, oil and coal, authoritative estimates were obtained as to the amounts of the above fuels required to heat the Mitten residence under conditions similar to those experienced during the first season.

The past season's experience with electric house heating indicates that it has some very definite advantages, some of which are enumerated below:

1. The silent operation of this electric house heating plant, maintaining an even temperature regardless of outside weather conditions, is a source of satisfaction to the home owner.

2. There is no possibility of failure to obtain heat storage with this system because of interruptions of service; the time clock, which controls the heat storage period, being electrically operated, any interruption to service will only delay the charging period.

3. The Mitten residence was served from existing distribution lines, the only difference in installation being the use of a 50-kva. transformer in place of a $7\frac{1}{2}$- or 10-kva. transformer, which would have been required to serve local customers with light and other electrical requirements.

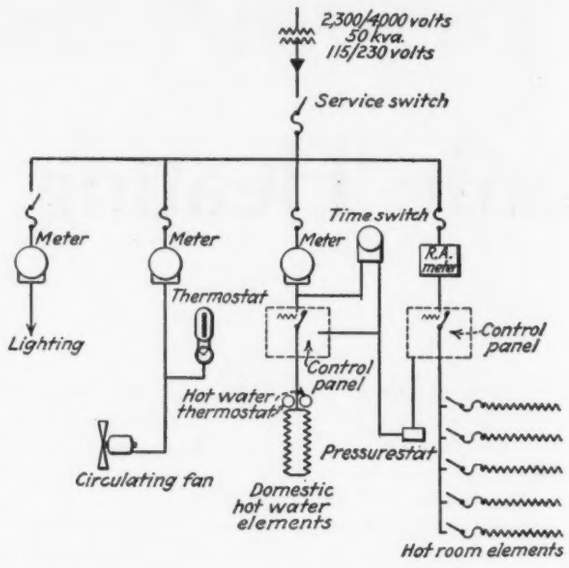
4. Inspection of the system after one year's operation indicates a very low maintenance cost.

5. The amount of heat storage is very flexible and depends upon the allowable off-peak operation, storage tank capacity in gallons of water and the electrical capacity in kilowatts of connected load. The past season's experience shows that the present storage capacity could be made ample for a 48-hour period of zero weather were the tanks filled to the full 1,000 gal. of water capacity and operated at a pressure of 50 lb. gage.

6. Variation in weather conditions need not be antici-

Gas Less Expensive

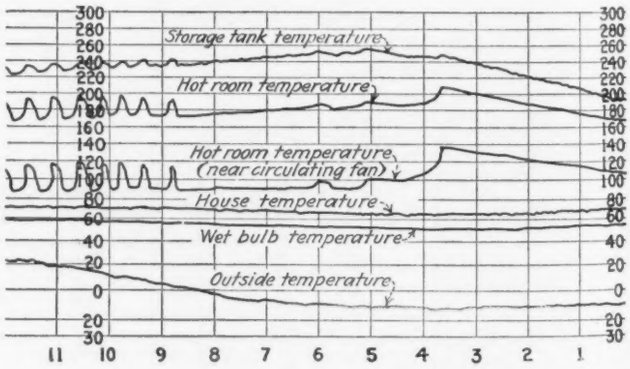
Electrical energy used during 1928–29 (actual), kw.-hr.	34,050
at 1 cent per kilowatt-hour	$340.50
Gas consumption (estimated), cu.ft.	290,000
at 90 cents per 1,000 cu.ft.	$261.00
Oil consumption (estimated), gal.	2,140
at 7 cents per gallon	$149.80
Coal (estimated), tons	11
at $12 per ton	$132.00



Control and meter layout covered every detail

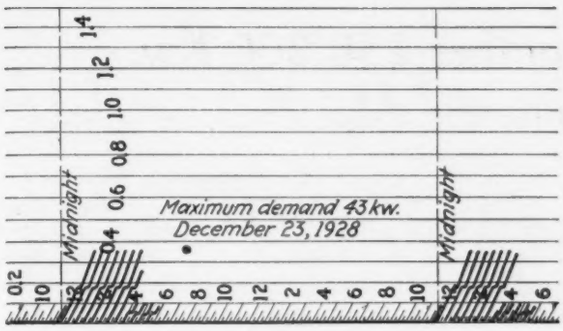
At 12 o'clock midnight the time clock closes the automatic control circuit in the heat storage room and the domestic hot water heater. The 40 kw. of heating capacity in the heat storage room builds up temperature and pressure in the heat storage tanks. Pressure regulator can be varied to control the system at any pressure from 10 to 60 lb. gage. Should the pressure in the storage tanks decrease 3 lb. after the tanks have reached the fully charged condition, the pressurestat closes the control circuit and allows further heat storage provided the charging period has not expired.

A thermostat prevents temperatures in excess of 135 deg. F. on the domestic hot water supply. When the time clock reaches the 6 a.m. setting the entire control system is automatically opened, thus disconnecting the "hot room" and hot water heater until the following midnight.



A complete story of temperature conditions was secured

A recording resistance thermometer was installed in the basement, to obtain a graphic record of temperature every three minutes at six different locations. One bulb is located in the return air duct of the dining room and is equipped as a wet bulb thermometer for obtaining wet bulb temperatures used in humidity calculations. An outside air temperature bulb is located on the north side of the house near the west corner. The other four temperature bulbs are located at various points in the "hot room."



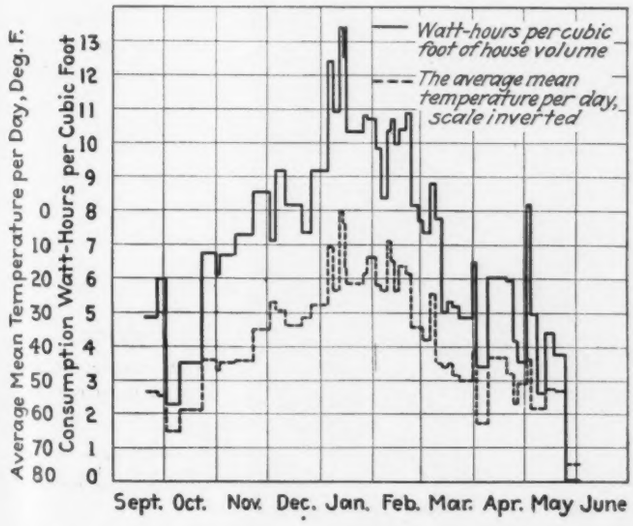
No increase in distribution capacity is required

Although the total connected load for heating the house is 50 kw., distributed over the five heat storage tanks, the house was heated during the 1928-29 season, as well as the present season, with only four tanks, or an electrical load of 40 kw. The transformer serving this load and local lighting load is rated at 50 kva.; experience indicates that a 37½-kva. transformer would have been ample, considering the fact that this load is not coincident with local lighting and occurs during cold winter weather.

pated by the home owner. This condition is automatically taken care of by the length of heat storage from day to day.

7. Although adjustments of various parts of the system were required at the beginning of the season, such adjustments were minor considering the fact that this installation was the first of its kind in this territory and, with the exception of a single installation at Fort Wayne, the first in the United States. The operating log shows practically no attention since February 1, 1929.

8. The high relative humidity of electrically heated buildings makes for more healthful living conditions. This condition is due to the fact that an electric heating system requires no combustion, thus eliminating the drain on the oxygen in the house to support the combustion of fuels in a basement furnace. Relative humidity in the Mitten home was found to be far above the average home, varying from 40 deg. to 60 deg., although water-evaporating or other humidifying equipment was not used.


Watt-hours per cubic foot of house volume
The average mean temperature per day, scale inverted
Average Mean Temperature per Day, Deg. F.
Consumption Watt-Hours per Cubic Foot
Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June

Energy use follows temperature variation closely

Thus the experience of the Public Service Company of Northern Illinois at LaGrange indicates that the off-peak electric thermal storage method of house heating is very practical and entirely satisfactory.

▼ ▼ ▼

Overhead Ground Wires Equalize Station Potentials

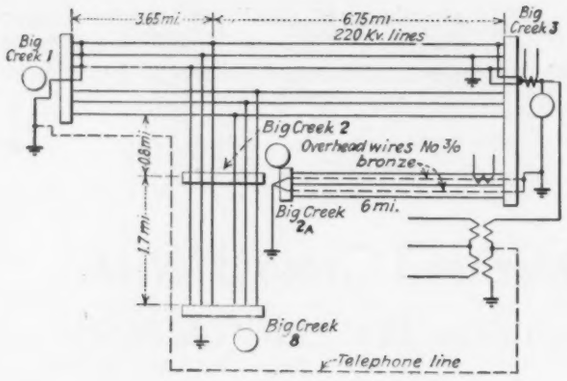
By LLOYD F. HUNT
Southern California Edison Company, Los Angeles, Calif.

HAVING experienced some damage to telephone protective equipment at the several Big Creek hydroelectric plants of the Southern California Edison Company during flashovers to ground on the 220-kv. system, it was decided to conduct a series of tests to determine the ground potential difference during cases of trouble. Also it had been observed during flashovers that there was an unequal distribution of ground current between stations, and in some cases the ground current was insufficient to operate protective equipment. Moreover, the possibility of remote control and remote metering between stations is entirely dependent upon the satisfactory equalization of ground current and ability to maintain a minimum difference of ground potential between stations during flashovers.

The cause of this unequal distribution of ground current was thought to be due to the fact that the various station grounds tapped different strata of the earth formation, which in the locality of the Big Creek plants is mostly granite. If this proved to be the case it was thought that an overhead ground wire between stations, or "sky wire" so called, would remedy the situation. Existing ¼-in. steel ground wires on the transmission towers are of such high resistance that their effect in equalizing ground potentials during flashovers is negligible.

Tests were made by utilizing one of the 28,000-kva. generators at the Big Creek No. 3 plant (see diagram) as a single-phase source of power and connecting the machine to the 220-kv. line by jumpering out the transformers. The fact that the neutral of the generator was grounded made it necessary to use only one terminal of the machine. This was connected to the two outside phase wires of the transmission line, with the third conductor used as an overhead ground wire. It was so arranged that the generator could be connected to any of the transmission lines with the other end of the line grounded at any one of the other stations desired.

With this set-up it was found that 60 per cent of the ground current between plants Nos. 3 and 2 passed over the transmission conductor being used as an overhead ground wire. Results of this test led to installation of two No. 3/0 bronze cables with No. 2/0 copper equivalent conductivity between plants Nos. 3 and 2-A., as shown by the diagram. Later tests were made to ascertain the actual benefit derived from these overhead ground wires and to determine what advantage there might be in tying in the grounds between other stations



Set-up used to determine division of ground current between earth and overhead ground wire

with similar overhead ground wires. These tests showed that 66 per cent of the ground current between plants Nos. 3 and 2-A actually flowed over the two No. 3/0 wires installed.

Based on tests using a transmission conductor as an overhead ground wire, calculations showed that two No. 3/0 bronze cables between No. 3 plant and the other plants would carry 80 per cent of the ground current. Since the installation of the overhead ground wires between plants Nos. 3 and 2-A telephone disturbances have been materially reduced and ground current distribution has been greatly improved.

Based on these tests and the one installation of overhead ground wires mentioned it is evident that overhead ground wires connecting all of the Big Creek plants would be desirable.

Another 250,000 Kw. from the Alps

ACCORDING to Nikolay Kotschubey of Zurich, the Bernische Kraftwerke A.-G. and its subsidiary, the Oberhasli A.-G., will build three hydro-electric power stations to use the headwaters of the Aar, flowing through the picturesque Haslital in the Bernese Oberland. The source of the Aar is situated in glaciers below the Finsteraarhorn. An annual runoff of about 54,000,000,000 gal. can be expected from this area. Near the Grimsel Hospice two dams have been built in order to form a storage reservoir of 22,000,000,000 gal. A second reservoir is situated 200 ft. lower and together with a natural lake, the Gelmersee, allows the storage of about 2,500,000,000 additional gallons. The three power stations will be situated at Handeck, Boden and Innertkirchen and produce yearly a total amount of about 550,000,000 kw.-hr.

The construction of the first power station at Handeck has been practically accomplished. Eventually, this power station will contain four Pelton type vertical turbines, developing each 25,000 hp. at 500 r.p.m., each turbine being coupled to a three-phase, 11,000-volt, 50-cycle, 25,000-kva. generator. The pressure is then stepped up to 50,000 volts and the current carried away by underground cable, the latter being used in order to avoid damage of the transmission line from snow and avalanches. The cable is drawn as far as Guttannen, where it connects with an overhead transmission line. At the Innertkirchen substation the voltage is raised to 150,000 and the circuits run to Berne and Basle, 40 and 90 miles distant respectively. The two other power plants, the construction of which has not yet been accomplished, will be installed, one at Boden with four 22,000-kva. generators and one at Innertkirchen with four 13,000-kva. generators.

Two dams will impound 22,000,000,000 gal.

The Hospice and the two lakes will be inundated by the pond.

ALEX DOW

on Power Plants and Systems—

"They Have to Be Lived With"

"LIKE the Quaker's wife, perhaps we in Detroit are also a little queer. At any rate we have been accused of harboring and indulging certain eccentricities of system design and operation that appear to our critics to be nothing more than eccentricities. But to us they are really much more than just arbitrary deviations from the customary practice. They are our norm.

"Prominent in our queerness is the habit—it is now so firmly based as to be a habit—of putting a separate 250-volt direct-current plant in our power houses for the operation of auxiliaries. I have been argued with, prayed over and exhorted many times in regard to this habit. I have been told that it is all wrong, that it wasted energy and money. But the conviction of sin never came to me from these exhortings; I remained, and still remain, fixed in my way of thinking, because I know that those plants are liked by the people who have to live with them. That is the final test of power plants as it is of people, living with them every day. From this test our plants emerge happily; we do get along with them in a pretty satisfactory way.

"These separate d.c. plants are large enough to be economical. When you are working with sets of 2,500 kw. and over—the sets in our later stations are 4,000 kw., capable of steady operation at 6,000—when you are working with such sets, running with condensers or running them in such a manner that any steam bled from them is used properly, the actual economy can be quite high. And you have an entirely independent plant of a peculiarly reliable character. I have known some of the best plants in the country to be shut down because of trouble with auxiliaries. Before I make my next remark I am going to tap wood; the remark is that we have had no trouble with our direct-current auxiliary plants. Nor are we likely to have trouble. The generators are big and slow. The auxiliary drive motors have the best possible speed control and high efficiency at low loads and average loads. The distribution busbars are run around the station basement quite casually. The copper bars are supported by Alberene cleats and insulated with three turns of sailcloth sewed on. The generators are electrically central as to the auxiliary load, so that transmission losses are low. Starting and safety gear is of the simplest. To take a generator off, all that is required is to shut the throttle. A reliable reverse current relay does the rest. Starting an auxiliary generator is just as simple. Open the throttle and let it come to speed and a balance voltage relay puts it into circuit. And any part of the auxiliary system can be handled while it is hot, which is more than can be said for any alternating-current method.

"As to economy, the proof of the pudding is, of course, the eating of it. Our stations don't do so badly in total economy.

"In the twelve months ended October 31, 1929, the actual net output—and remember, that output is strictly verified—the net output of the power houses to transmission lines and distribution lines was 2,637,753,600 kw.-hr. Suppose you say that the net output was more than 26 hundred million. Now in net output, please remember, there is no auxiliary power included. For the whole system our B.t.u. per kilowatt-hour for the whole twelve months was 16,840. That figure compares somewhat unfavorably, of course, with the occasional record run . . . But I do not know of any outfit in the country that is getting out any such amount of current with that net efficiency. That is to say, I do not know of any outfit in this country or elsewhere with such an output which is approximating that efficiency for a complete system. There are special cases where the figure is bettered. In each such case, when you come to analyze it, there is good reason why it should be so. Our

load factor tends to fall between 50 and 54 per cent.

"If that efficiency is not the best, it is at least far up in its class. That it might be better is quite true, because here is the old Delray plant that had an output of 298,000,000 kw.-hr. at 22,000 B.t.u. per kilowatt-hour. Here is Connors Creek—the efficiency of which has never varied much excepting during the period when Uncle Sam's fuel board thought it knew more about what coal we ought to burn than we did, and dealt us some rather rotten coal—with 755,000,000 kw.-hr. output at 19,290 B.t.u. Marysville drops to 15,430 with 417,000,000 output. Trenton Channel, which has furnished more than 40 per cent of the entire output, has a record for twelve months of 14,390 B.t.u.

"Our whole design is based upon total output for a large system and, of course, ultimately for kilowatt-hours delivered to consumers' premises. *We have never sought for records in any one plant.* That we have made occasional records is true. The making of these has been an incident to our main purpose. We have never gone out for a record. We never used any cruel and unusual arrangement of generators and boilers or anything else. While we have been progressive, and at times leaders, we have never gone out for the blue ribbon for one hour or for one second of any one hour. We have simply tried to make our plants contribute to the best final economy—not to operating economy alone—of the entire system. We have designed and built them so they would get along in and with the system, so we could live with them in peace and contentment. And direct-current auxiliary generation has helped a lot.

"Another habit of ours that has inspired inquiries—sometimes they are questionings of our intelligence, but polite ones, of course—is our loose-linkage method of operation. With four power houses located well apart from one another—the two farthest apart having a separation of 80 miles—it is out of the question to put in tie lines merely for the purpose of interchange of current. Each power house has its own service area. That area can be increased or decreased by changing the point of interlinking from one switching station to another, and that variation of area is made when increased output or decreased output of any power house is desirable. The interlinking of adjacent areas is, in each case, and at all times, sufficient to transfer the output of one generator, so that the loss of a generator will be taken care of for the moment by the other areas. An uncontrollable fault in one area causes that area to break loose from the others and does not pull down the entire system. We have heard arguments regarding the desirability of having all of the system's energy available to clear a fault. That amount of energy is not necessary in our case. Thanks, in considerable degree, to our habit of d.c. auxiliary generation, any one of the power houses can deal with its own local disturbances quite adequately, and if in dealing therewith it falls away from correct speed, it does not thereby set all the other power houses swinging into lost synchronism. That statement is not based upon theory, but upon long-time practice. The method seems to work also with our interconnection with our good neighbors to the west. In brief, we have sufficient interconnection to give maximum operating economy. At the same time the linking is so loose that it does not involve interruption of service over all of southeastern Michigan, if there is a bad cable or busbar fault.

"I have no desire to be an evangelist, to preach our Detroit habits as a gospel for the salvation of the art and business of electricity supply. But they are *our* gospel and I defend them. We have established their verity by experience in our conditions. We live with them and we like them."

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Water Heater Data

DATA on the use of water heaters by ten families in city and suburban residences on the lines of the Ohio Edison Company were presented at the second annual Rural Service Men's Conference in Columbus, Ohio. Various periods are covered, up to twelve months in two instances. The following figures were found:

Item	Average	Maximum	Minimum
Tank capacity, gal.	76	120	40
Average monthly, kw.-hr.	265	438	114
Average monthly, gal. water	928	1,530	400
Average monthly bill	$3.18	$4.49	$1.66
Persons in family	3.7	5	2
Averages per person:			
Monthly kw.-hr.	72	101	35
Monthly cost	$0.88	$1.22	$0.46
Daily gal. of water	8.5	11.8	4.1

The rate for energy is 1½ cents for the first 100 kw.-hr. and 1 cent for all additional.

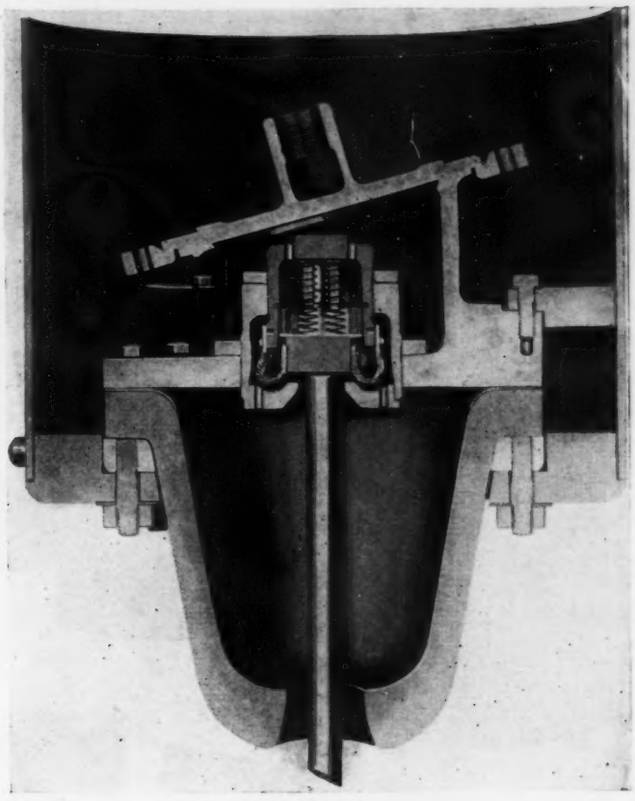
Adequate Regulation Removes Terror of Big Business

THE decision just given by the Supreme Court in the International Shoe Company case says that *mere acquisition by one corporation of the stock of a competitor is not forbidden, if the intangible factor known as "public interest" does not suffer.*

Previously the public and Congress feared big business merely because it was big; now it fears it only when it is not regulated. In the case of railroads, once dreaded, a friendly government is now patting them into consolidations, under the careful qualifications, however, of the transportation act.

It is apparent that *so long as these big new amalgamations are outside the pale of effective federal control popular distrust exists,* and all the discomfort of "trust-busting" must be expected. *When the tardy process of governmental regulation finally catches up these mammoth businesses lose their terrors* even as they become yoke-broken. Manifestly, *it is as much to the interest of the big business itself as it is to the public that this process of more adequate federal supervision should be expedited.*

—*Christian Science Monitor.*



A molded, non-metallic explosion chamber, modification of contacts including stored energy in springs and quick and positive oil action on the arc are features of the new 230,000-volt breaker

New High-Speed Breakers

Features of 230,000-volt, 2,500,000-kva. breakers used by New England Power Company. Explosion pot modified to get quick action

By H. E. STRANG

Switchgear Department, General Electric Company, Philadelphia, Pa.

RECENT interest in the development of high-speed switching equipment to preserve stability on large and growing systems and interconnections may have prompted the thought that this application could only be met by bringing forth some radically different interrupting device than had hitherto been known. However, an orderly and logical development of long-known principles of circuit interruption and mechanical operation can be made to meet these increasingly more stringent requirements. This is exemplified by a brief review of the first commercial high-voltage, high-speed oil circuit breakers now being shipped from the Philadelphia Works of the General Electric Company.

These breakers, of which there are seventeen, will be installed at the Fifteen-Mile Falls, Andover and Tewksbury stations of the New England Power Company's new development. They are type FHKO-239, 108-C F7 and have an interrupting rating of 2,500,000 kva. at 230,000 volts. They are of the explosion chamber design, using a molded, non-metallic explosion chamber and having stationary contacts, slightly modified from previous forms in order to decrease the time elapsed from energizing the trip coil until the separation of the contacts. The operating mechanism is in reality a double motor-operated centrifugal device which closes the breaker contacts and simultaneously stores energy in springs to speed up the opening stroke. A special design of latch makes this mechanism trip free at any point of the closing stroke and is so located mechanically as to insure a minimum time loss from the application of voltage to the trip coil until the opening stroke is started.

The general assembly is novel in that the mechanism is located between one of the end poles and the middle unit. This conserves space in breakers of this size and makes possible the most desirable arrangement of the linkage between units.

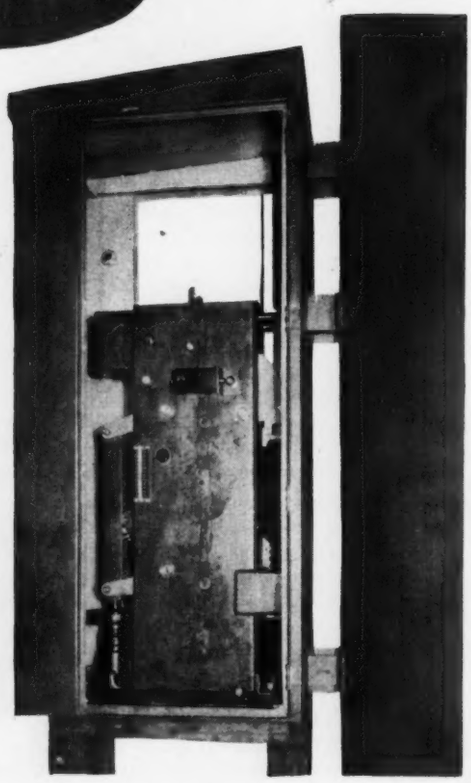
The general features of this design, both in regard to contacts and mechanism, were demonstrated by extensive field tests last August on the 220-kv. system of the Philadelphia Electric Company and covered in full in an article by R. Paxton in the October 12, 1929, issue of ELECTRICAL WORLD. These tests ranged from about 15 per cent to 50 per cent of the breaker's interrupting rating, or to the limit of available power. They indicated that, in contrast to the 20-cycle rating of a conventional explosion chamber breaker of this size, this design met the desired rating of 8 cycles from energizing the trip coil until the short circuit was extinguished. Sub-

Operating mechanism is protected and requires minimum space in the 230,000-volt breaker

The complete breaker is 39 ft. long over all, 23 ft. high to the top of the bushings and 12 ft. wide. The tanks are 108 in. inside diameter, made of ½-in. thick steel, and contain 13,700 gal. of oil per triple pole. The weight of the completely assembled breaker with oil is about 92 tons.

Practically the entire breaker and mechanism are made up of fabricated steel parts, electrically welded. The fabricated steel dome with the bushing supports is welded directly to the tank, eliminating the bolted and gasketed joint at this place which was encountered in previous designs. A generous-sized manhole in the dome provides access to the interior.

In order to receive the maximum benefit from this decrease in breaker operating time, it was necessary that similar steps be taken in relay development, and as these proceeded hand in hand complete protective equipment to meet present-day problems is now available. Although an oil-circuit-breaker-operating time of 8 cycles in the higher voltages seems adequate to meet any immediate needs, developments under way indicate that quicker operation may be possible should the necessity present itself.



Motor-operating mechanism for 130,000-volt breaker

sequent improvements, principally in the nature of eliminating lost time before contact separation, make this 8-cycle over-all rating very conservative. Although the contact-opening speed is somewhat higher than in the case of previous standard breakers, the entire design has been considered on that basis and the operation is not such as to place undue stress on any parts or cause any concern over possible ability to stand up over years of normal service.

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Safety Activities on Electrical Properties*

II—Activities of Workmen's Committees

EXPERIENCE shows that accidents have been reduced in most cases by those companies which consider the elimination of unsafe practices as the primary function of safety committee work. While the improvement of physical conditions and the safeguarding of machinery in the plant are essential to demonstrate to employees the attitude of the management regarding safety, unsafe working methods are recognized as important contributing causes of most accidents.

The workmen's safety committees of fifteen companies are engaged largely in encouraging safe practices on the part of employees.

Advertising has been found to be an effective means of establishing habits of safe workmanship among employees. Bulletin board displays or signs are most frequently employed. Safety messages, preferably containing one central thought, are changed frequently and so placed that they can be read easily and will command the greatest possible attention.

Locations generally selected for displays include store rooms, boiler rooms, wash rooms, time offices, linemen's

*See ELECTRICAL WORLD, April 26.

room, garages, work trucks, shops, substations and places of assembly.

The development of friendly rivalry in the prevention of accidents has usually proved an effective means of sustaining and intensifying employee interest in safe working habits. A few of the reporting companies conduct safety contests, using lost-time accidents as a basis for rating the various units. The department making the greatest reduction in frequency or severity rates for the current year or for a given period compared with similar months of the previous year is regarded as the winner.

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Convenient Line Drop Voltage Chart

By R. J. OWENS

Southeastern Engineering Company, Birmingham, Ala.

A CONVENIENT form of chart has been used for a number of years by the writer for making rapid calculations of line performance. It is constructed for reading the load in terms of kva. or amperes and power factor by polar co-ordinates. As may be seen from Fig. 1, the chart reads the graphical solution according to the fundamental formula for short lines,

$$\text{Delivered voltage } V = \sqrt{(E\cos\Theta - RI)^2 + (E\sin\Theta - XI)^2}$$

The magnitude of ZI and its angular relation to E determines the voltage drop $E - V$. For a given circuit of voltage E, the ZI drop is proportional to kva. The power factor determines the angle $(\varphi - \Theta)$. Therefore for solving $E - V$ the kva. load at a power factor $\cos\Theta$ may be expressed in the form of a ZI drop at this angular relation to E.

In Fig. 2 point O is the reference point corresponding to zero load and zero voltage drop; vector E is made the vertical axis. To graduate the chart, angle φ and Z are calculated from the characteristics of the line. A full load is assumed and ZI is computed; this gives ratio between kva. and ZI or $E - V$ when $(\varphi - \Theta) = 0$ degrees. The power factor scale is graduated by plotting the angle $(\varphi - \Theta)$ corresponding to the various power factors.

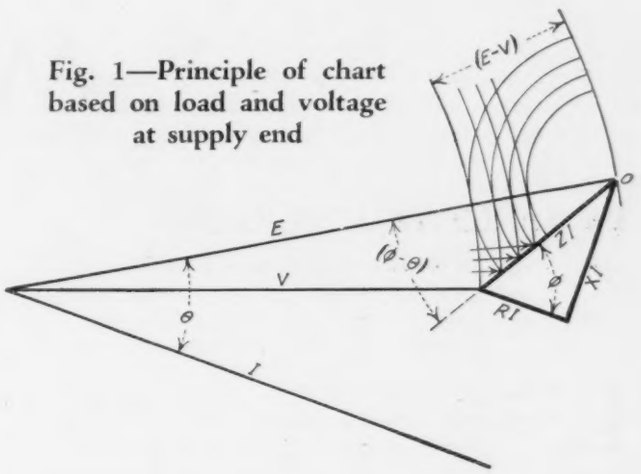

Fig. 1—Principle of chart based on load and voltage at supply end

A similar form of chart may be constructed for finding the supply end voltage from the receiver end voltage. Both charts may of course be graduated to read direct in volts for a specified line or may read in per cent if more than one scale of load voltage is to be used.

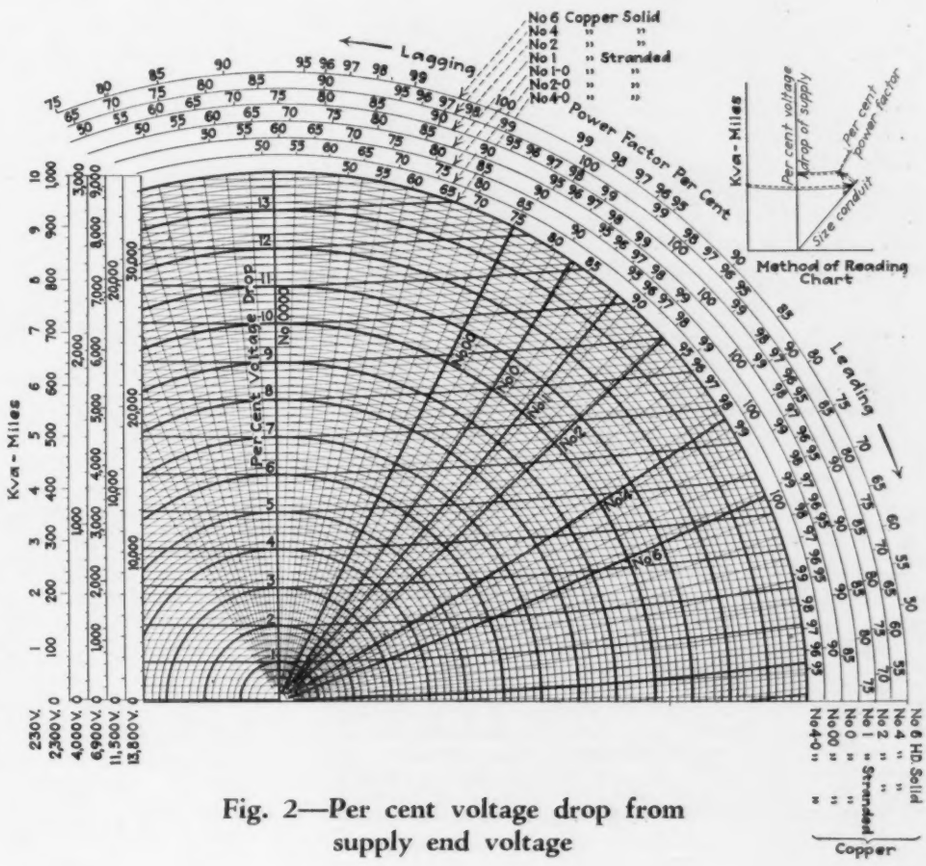

Fig. 2—Per cent voltage drop from supply end voltage

The chart is based on flat spacing of 54 in. effective of various conductors on 8-ft. N.E.L.A. arm. For smaller than No. 4/0 conductors ratio curves are plotted between the kva. circles and voltage circles for reducing kva. load of smaller conductors to an equivalent kva. load on the No. 4/0 conductors on which the chart is based.

For drop on single-phase circuits multiply load kva.-miles by 2 and apply direct to proper voltage scale. For drop on three-phase, 23,000-volt circuits divide load-kva.-miles by 100 and apply to 2,300-volt scale.

Voltage regulation per cent =
100 × per cent drop.
100 — per cent drop.

Lower Rates— More Business

By BARCLAY J. SICKLER

Frazer & Torbet, Accountants, Chicago, Ill.

Analysis of unit rates and energy consumptions in 43 small towns indicates definite relation between the two. Quantitative statement of ratio prevented by other influencing factors

IT IS almost a truism that the quantity of goods and services used, whether electric current or automobiles, is greater at lower prices than at higher. The importance of obtaining measures of the extent to which demand increases with a lower price cannot be doubted, although little has been done on that line. In the electric light and power industry, for the one purpose of forecasting the effect of proposed rate changes, such measures would appear to be invaluable.

Probably the explanation of the few studies of this character is the difficulty of finding situations sufficiently simple to make it possible to isolate the effect of price changes. In the field of electricity, such a study, to get trustworthy results, must include only strictly comparable rate areas served at different rates at the same time. Unless the rate areas compared are very much alike, economically and socially, the difference in consumption of electricity due to extraneous influences will obscure the variations due to different rates. It is also important that the communities compared be served by companies pursuing the same policies in regard to stimulation of consumption. A company which aggressively seeks new business can secure much more consumption per customer at the same rates than one which does not. In addition, unless the communities are compared for the same period of time, the effect of different rates will be hidden by the fact that people continually become more electrically minded, and hence each year use more electricity per capita.

It was with these considerations in mind that the group of communities used in this study was chosen. This group consists of 43 adjacent small towns, ranging from a population of sixteen to one of 1,230, situated on the western edge of the Mississippi Valley. These are all "farming" towns, and their economic and social activities are as nearly identical as is possible. They are served from the same electric system and the average rates charged in 1928 ranged from 13 cents per kilowatt-hour to over 23 cents. In this study the amount of electricity consumed per customer in the year 1928 is averaged for all communities served at the same average rates, and the consumption per customer compared between different average rate groups. A summary of the results is given in Table I.

Table I—Consumptions in Relation to Rates

Average Rate per Kilowatt-Hour, Cents	Kilowatt-Hours Sold per Residence Lighting Customer	Kilowatt-Hours Sold per Commercial Lighting Customer
23 and over	131	182
21 and 22	166	242
19 and 20	169	252
17 and 18	183	388
15 and 16	210	473
13 and 14	302	642

This table shows that the kilowatt-hours consumed per residence lighting customer increased from 131 at a rate of 23 cents and over to 302 where the average rate was 13 cents to 14 cents. This increase amounts to 130 per cent, while rates decreased 40 per cent. The kilowatt-hours consumed per commercial lighting customer increased from 182 at 23 cents and over to 642 at an average rate of 13 cents to 14 cents, an increase of 250 per cent with a 40 per cent decrease in rates. Thus, for the communities studied, a 1 per cent decrease in rates is accompanied by 3¼ per cent increase in use by residence lighting consumers and 6¼ per cent by commercial lighting users.

Population versus consumption

It should be mentioned, however, that part of this increase in consumption probably results because the towns with the lower rates are larger on the average than those with higher rates. The average size of the towns serving residence lighting consumers at 23 cents and over is 118, and that of those serving these consumers at 13 cents to 14 cents is 1,095. Similarly, for towns charging commercial lighting customers an average rate of 23 cents and over the average population is 295, and where 13 cents to 14 cents is charged the average size is 960. It was noticed in making this study that at the same average rates larger towns usually used more electricity per customer than the smaller ones. This fact is brought out in Table II, where the consumption per customer is shown by size of towns for those towns served at an average rate of 15 cents to 16 cents.

Whatever the reason, the fact that the larger towns

Table II—Consumptions in Relation to Population

Average Size of Town	Kilowatt-Hours Sold per Residence Lighting Customer	Kilowatt-Hours Sold per Commercial Lighting Customer
100–199	191	339
200–299	...	...
300–399	195	377
400–499	...	553
500–599	199	...
600–699	...	508
700–799	202	513
800–899	...	...
900–999	237	608
Over 1,000	218	425

This table shows that on the whole there is larger consumption per customer at 15-cent to 16-cent rates in the larger towns than in the smaller ones. The increase is not regular throughout the range of community size, but in view of the small number of towns used this is not surprising.

The residence lighting group at 15 cents to 16 cents contains eight towns, there being one town in each population group except for one group which has three towns. There are nine towns where commercial lighting customers are served at 15 cents to 16 cents, with one town in each population group except for two groups of two towns each. No chance is given for the small extraneous differences which do exist between the communities to average out. The larger consumption per customer in the larger towns is probably due to the fact that they have usually had electric service for a longer time, and the habit of using the service has become more firmly established.

do use more current per consumer at the same rates seems to be true. Applying this to the first table, we are forced to conclude that not all of the increased consumption per user at lower rates was due to the lower rates, but partially to the fact that the lower rates on the average are in the larger towns. The extent of this influence is impossible to determine with the limited data used here.

Another aspect of the development of the market for electricity besides the amount used per customer is the number of persons in the community per electric meter.

Tables III—Rates in Relation to Persons per Meter

Average Rate per Kilowatt-Hour, Cents	Persons per Residence Lighting Meter	Persons per Commercial Lighting Meter
23 and over	5.4	12.7
21 and 22	6.2	9.3
19 and 20	6.6	11.8
17 and 18	5.2	10.9
15 and 16	4.6	12.2
13 and 14	3.8	10.8

Although the results are not regular in either persons per residence lighting meter or per commercial lighting meter, the general conclusions deducible from the above table seem to be as follows: Persons per residence lighting meter decrease with lesser rates; that is, the market is more fully developed when lower rates are charged. In the case of persons per commercial lighting meter, the rate seems to have no effect on persons per meter, the movement of this ratio in Table II being entirely haphazard. The explanation of these different reactions is probably that every commercial establishment finds it necessary to have electric connections where service is available, no matter what the rate, although it can cut down on the amount used. A residence user, however, can do without service altogether if the rate is considered to be too high.

Accordingly the number of persons per meter in these towns was studied in relation to the average rates charged as shown in Table III.

The reader may object to this study on the basis that the quantitative results obtained do not apply to more usual situations where larger towns of industrial character served at lower rates are concerned. Thus it might be argued that an industrial town of 50,000 population served at an average rate of 8 cents per kilowatt-hour would show either a greater or lesser increase in consumption per customer than 3¼ per cent for residence consumers and 6¼ per cent for commercial lighting users at a 1 per cent decrease in rates. This might be said to be true either because of the different social and economic characteristics of urban population, or because the decrease was being made from a rate already lower than in any of the cases used here. The writer has no convictions on these questions and would be very much interested in seeing a similar study made for a different type of market.

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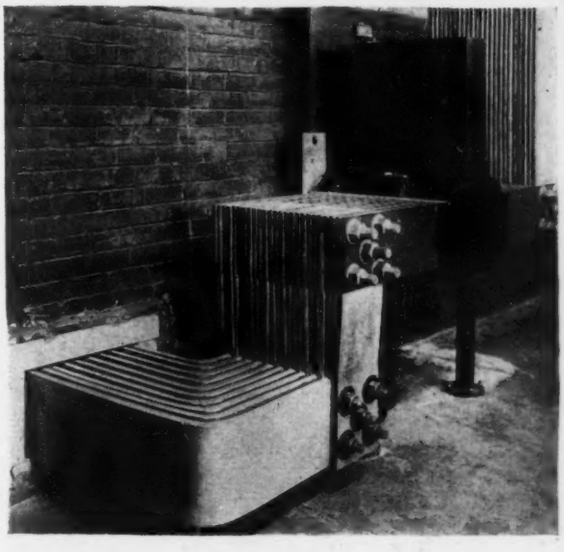
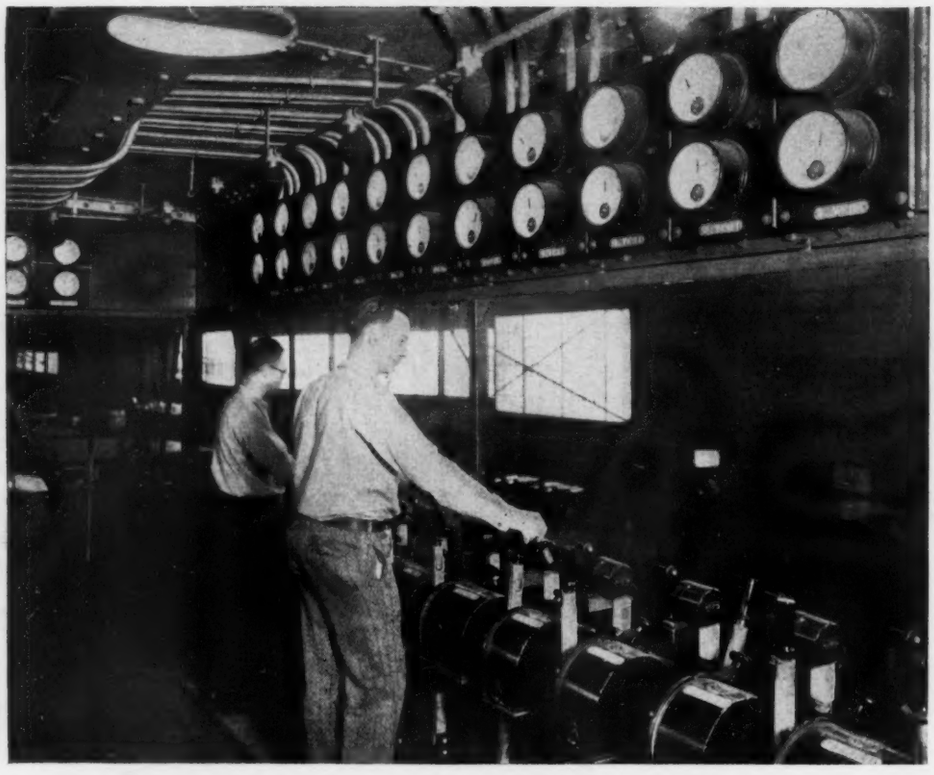
50,000-Amp. Aluminum Bus and Shunt

By J. ELMER HOUSLEY
Alcoa, Tenn.



A 50,000-amp. direct-current shunt made by Sangamo and operating a mercury type watt-hour meter, a recording and an indicating ammeter recently had to be placed in service at the plant of the Aluminum Company of America, Alcoa, Tenn. The bus leading to the shunt is made up of ten 1x12-in. aluminum bars. Connecting the bus and shunt are 24 ½x10-in. aluminum bars. To maintain the high initial contact pressure between the bars in the joint a heavy steel spring washer and five 1⅛-in. steel studs are used at each joint. Two pipe stands with an insulating cap support the shunt. Over the resistance section of the shunt is a stack which creates a natural circulation of air for cooling the shunt.

Electric Drive and Control Make

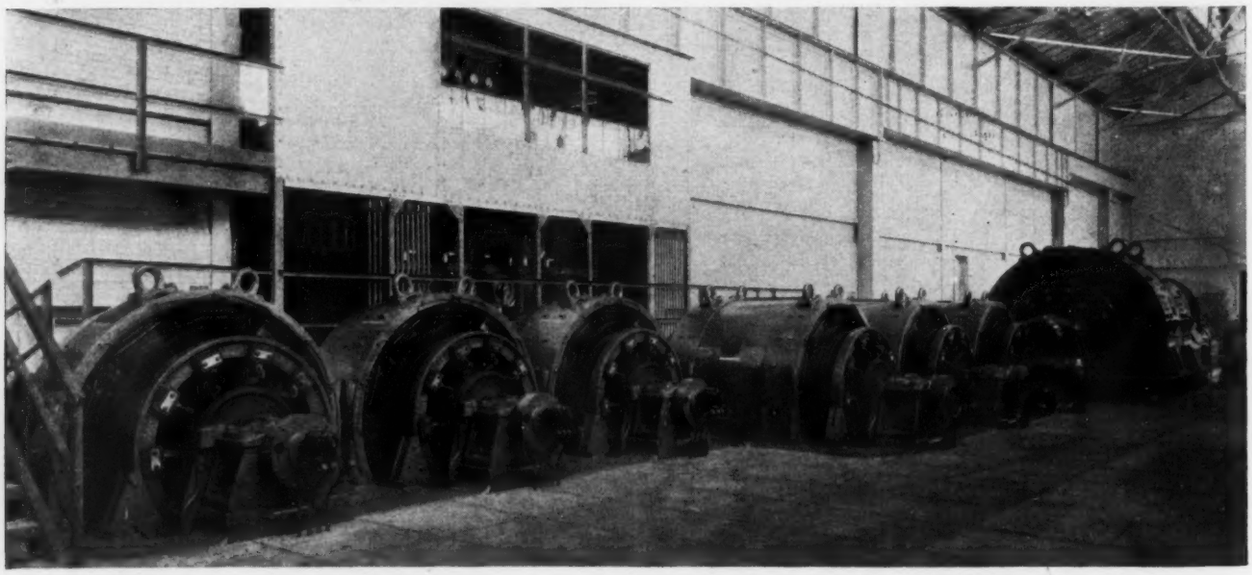


Continuous hot-strip mills entirely controlled from this pulpit

Indicating instruments and public address system guide operators and transmit instructions to roll attendants.

Photos Courtesy General Electric Company

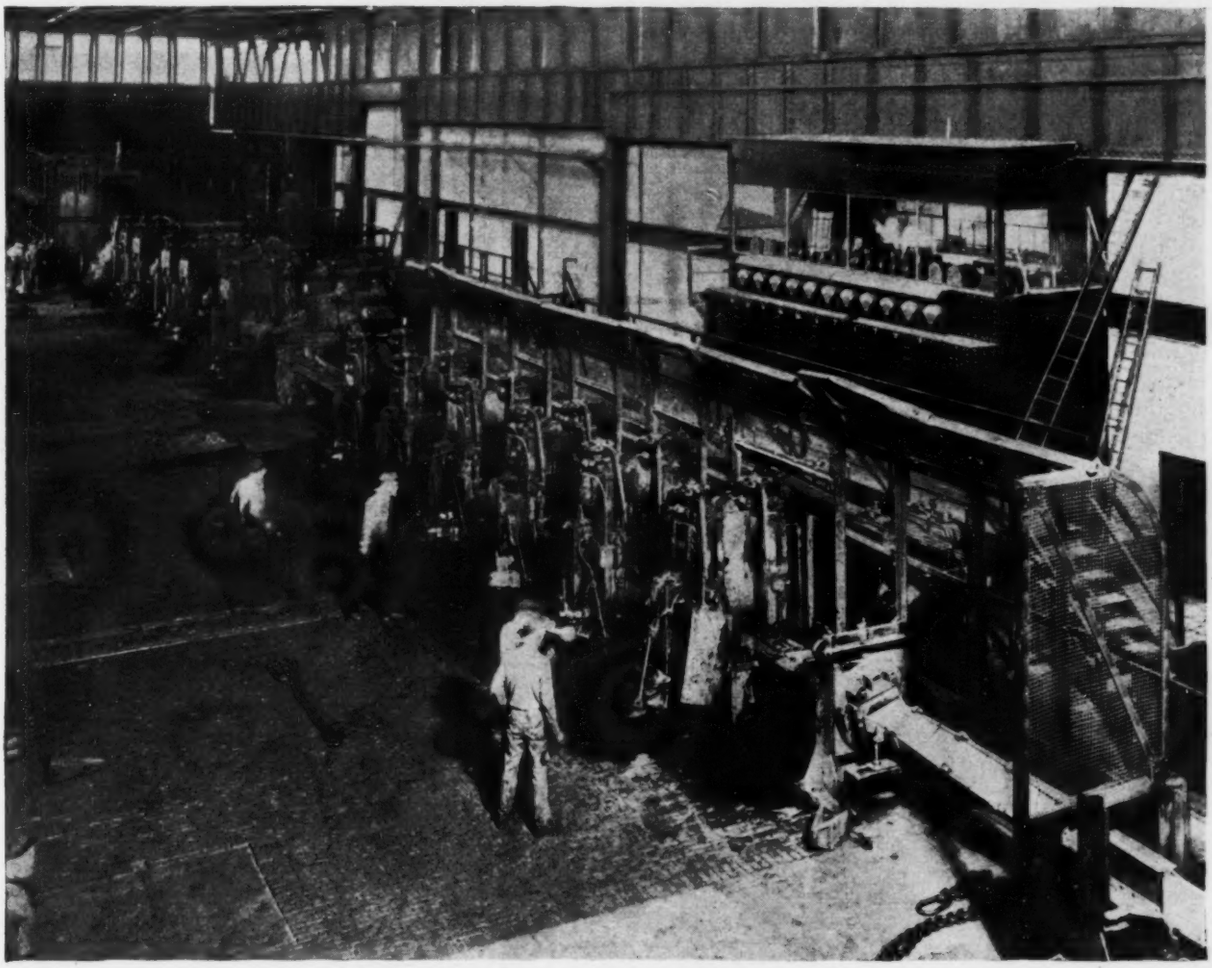
FORTY-FIVE thousand horsepower in motors, with their complement of control equipment, and extensive applications of indicating and recording instruments are used in the high-speed steel-strip rolling mill which the Sharon (Pa.) Steel Hoop Company has recently erected to improve its product and reduce production expenses. Since a continuous hot-rolling process is used, the cold end of the strip reaches the shipping room before the hot end of the initial bar is completely out of the preheating furnace. This is possible because the initial 30-ft. bar is elongated



Compactly arranged finishing and roughing mill motors with relative speed controlled electrically

Possible

Compact, High-Speed Strip Rolling



Finished strip issues from the last rolls before the original bar completely leaves the preheating furnace
Note ammeters near pulpit window for guiding operations.

to 1,500 or 1,800 ft. in the process, the strip issuing from the last rolls at approximately 2,400 ft. per minute (26-27 miles per hour). This high-speed process requires precision control.

Because of the various products handled the rolling mill motors must have a speed range of one-quarter to full speed. Throughout the entire process the relative speeds of the motors must be maintained within one-tenth of 1 per cent. This is accomplished by automatic electric regulators. Space requirements and the desirability of duplicate designs in a wide variety of ratings were met by using a combination of single and double armature motors. The six finishing stands are driven by individual motors, aggregating 7,500 hp., mounted in groups of three on common bedplates. The roughing mill motor is rated at 4,500 hp. and 150/450 r.p.m.

While all the motors are controlled from a pulpit overlooking both the hot-strip mill and motor room, a modified public address system is used whereby men on the rolling-room floor can deliver instructions regarding operations and speed changes to the control pulpit.

Automatic Reclosing Breakers Reduce Outage Time

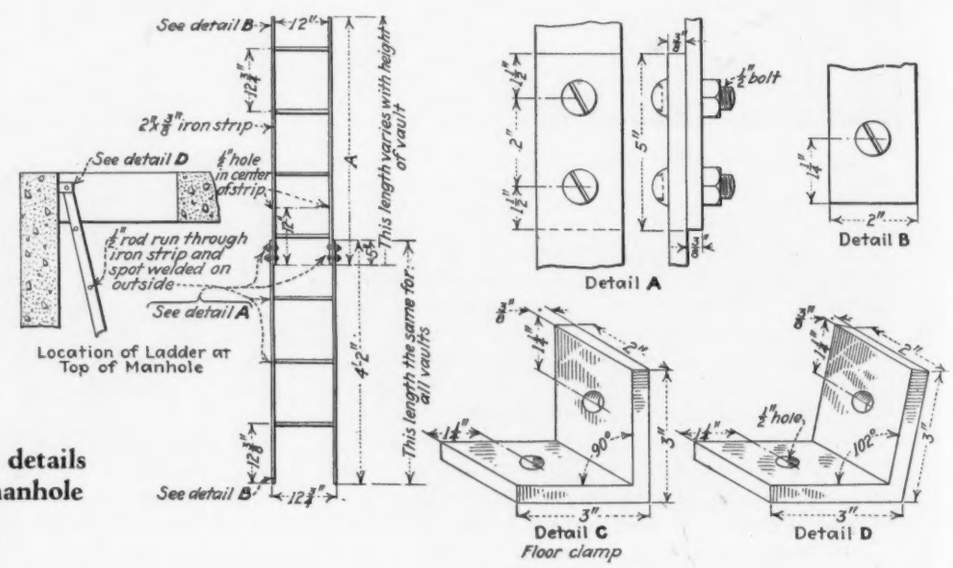
By E. R. STAUFFACHER
Electrical Protection Engineer,
Southern California Edison Company,
Los Angeles, Calif.

IN SUBSTATIONS where the load is not sufficient to justify the service of an operator, or where the operating force must be kept at a minimum, there is an increasing demand for automatic oil circuit breaker reclosing equipment to minimize the length of outage when trouble causes the breaker to open. By the use of a reclosing mechanism it is possible to restore service in a much shorter time than could possibly be done by any other practicable means at comparable cost. Operation of automatic reclosing oil circuit breakers has been quite successful on the system of the Southern California Edison Company and there have been only a comparatively few cases of the reclosing mechanism failing to function properly.

It has been found that in the majority of cases service is restored after one outage of fifteen to 30 seconds, depending upon the setting of the reclosing relays, even though the equipment is arranged to trip out automatically two or three times and reclose a comparable number of times if a short circuit is sustained. Experience indicates that short circuits are of a temporary nature, and apparently one trip-out with one reclosure covers most situations.

At present most of the reclosing mechanisms are adjusted for reclosures at intervals of from fifteen seconds to approximately one minute. The length of time between reclosures, which means the length of interruption, is a question around which there has been considerable discussion. It is the opinion of the writer that this time is entirely too long, and that much better service to the customer would result by making the intervals between reclosures approximately five seconds. Manufacturers feel that the interrupting capacity of the oil circuit breaker is reduced somewhat by shortening the time between reclosures, but more field data are needed to establish this fact definitely. Service conditions on the system of the Southern California Edison Company warrant trial of the practice of gradually shortening the time between reclosures until some concrete evidence is secured that the interrupting capacity of breakers is appreciably diminished by the shorter reclosure. If it is aimed to give the best possible service to the customer, an outage of 30 seconds or one minute should not be tolerated if only five seconds is necessary to assure clearance of trouble from the circuit.

During 1929 there was an increase of 44 per cent in the number of automatic reclosing oil circuit breakers installed on the Edison system, bringing the total to 303. These are divided as to voltage of circuit as follows: 2.3 kv., 30; 4 kv., 220; 11 kv., 36, and 16 kv., 17. Although the use of this equipment is comparatively new, its advantages are so marked that it is now considered as part of regular equipment where load and other conditions can possibly justify its use.



Construction details of standard manhole ladder

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Transformer Vault Ladder

By CARL W. EVANS
San Antonio Public Service Company

ACCESSIBILITY of transformer vaults is greatly increased by the use of small manhole rings and covers in addition to the usual equipment rings and covers or removable slabs. At a very low cost these small entrance rings and covers may be equipped with an iron ladder, which greatly facilitates inspections and rush surveys during times of system trouble.

In the accompanying illustration is shown the complete details for a ladder of economical proportions. A feature of this ladder is the standard length lower section, which is removable. It would be natural to make the ladder in a single section for vaults of ordinary depth, but the two-piece ladder has the advantage that the lower part can be easily removed, leaving the vault wall clear to average working height when cables are to be re-racked or other equipment moved about. The rungs are run through the side strips and welded on the outside of the ladder.

81,500,000,000 Kw.-Hr. from 137 Systems

SIZE of systems, rather than their number, marks the growth of the electric light and power industry. In the United States the 137 largest generate eight times as much energy as all others combined. More than half our total comes from the first 26, each having an output measured in billions. Canada contributes fourteen systems, Mexico four, transportation fifteen. The total for North America is 170.

LIGHTING has become one of the smaller uses. Industrial power at wholesale exceeds all other sales combined. Domestic consumption in these large systems is less than an eighth of the total.

ACCOMPANYING this issue the ELECTRICAL WORLD presents its annual tabulation of operating statistics of public utility systems in North America having an annual output of 100,000,000 kw.-hr. or more. The data are for 1929. Altogether 170 systems are listed—137 for light and power in the United States, fourteen in Canada, four in Mexico, and fifteen electric railways and electrified railroads. The list is believed to be complete; every care was taken to make it so.

The 137 light and power systems, with a combined production of 81,561,345,767 kw.-hr., account for 88 per cent of the energy generated in all public utility plants for light and power in the country, irrespective of size.

The growth compared with 1928 is one of size rather than numbers. At the bottom of the list (Supplement Table I) six new companies, previously too small, have advanced into the 100,000,000 kw.-hr. class. At other points several more have been added, notably by the presentation of individual statistics for companies last year grouped together in the system of the Southeastern Power & Light Company. Elsewhere the merging of previously independent operations has eliminated names. The formation of the Niagara Hudson system is a case in point. The result of these changes has been a net increase of three, if allowance is made for a duplication last year.

Energy statistics tell a different story. For 1928 the generated output of listed systems was 72,826,693,215 kw.-hr. The new total overshoots this by 12 per cent. The purchased energy now comes to 13,178,518,557 kw.-hr., exceeding the previous year's amount by 16 per cent. With this duplication, which, however, is almost exactly balanced by wholesale deliveries to other public utilities, the total energy output (Table III) rises to a magnitude appreciably larger than the generation for the entire industry.

At the head of the list (Table I, Supplement), and now by far the largest single system in the world, is the Niagara Hudson, followed by the New York Edison group and the Commonwealth Edison of Chicago, very close together in output. The tremendous developments on the Pacific Coast are decidedly in evidence, for among the first fourteen are three great systems in California. There are 26 systems in the billion kilowatt-hour class, with a combined output amounting to 57,191,852,664 kw.-hr., about 10 per cent of it purchased. Energy generated in their 548 plants constituted more than half the production of all public utility plants in the country.

What two years' progress signifies to the power industry can be brought out by another comparison: The 25,911,781 kw. of generator rating (Table III) of these 137 systems in 1929 was more than the total for the whole industry in 1927.

Two manufacturing regions produce more than half

The output and maximum load for each company is given for earlier years and for 1929 in Table I (Supplement). Examination reveals the steady growth of individual systems; the annual summaries bring out the changes in the country as a whole. In recent years these summaries appeared in the issues of May 18, 1929; May 5, 1928, and April 20, 1927, with corresponding Supplements.

Prior to this year the rating was tabulated in kilovolt-amperes: 22,559,063 for 1926, 24,275,311 for 1927 and 28,447,035 for 1928. If these are reduced to kilowatts on the assumption of 80 per cent power factor the resultant values are respectively 70, 75 and 88 per cent as great as for 1929.

Hydro plants are about three-fourths as numerous as fuel-burning plants, but are considerably smaller in average rating, nationally as well as regionally, except in the Mountain States. Hydro outranks fuel as to total

TABLE III—SUMMARY OF GENERATOR RATING AND OUTPUT

Section	Number of Companies or Systems	Number of Generating Plants and Generator Rating — All Plants — No.	All Plants — Rating, Kw.	Fuel Plants — No.	Fuel Plants — Rating, Kw.	Hydro Plants — No.	Hydro Plants — Rating, Kw.	Energy Generated, Kw.-Hr.	Energy Purchased, Kw.-Hr.	Total Energy Output, Kw.-Hr.
United States	**137**	**1,740**	**25,911,781**	**984**	**18,821,157**	**756**	**7,099,624**	**81,561,345,767**	**13,178,518,557**	**94,731,240,380**
New England	12	85	1,836,635	29	1,456,910	56	379,725	4,833,969,766	945,189,308	5,779,159,074
Middle Atlantic	22	292	7,117,414	134	5,597,622	158	1,519,792	23,248,037,098	2,850,246,869	26,089,992,313
East North Central	31	301	6,167,787	179	5,916,076	122	251,711	18,955,836,552	3,909,493,304	22,864,997,566
West North Central	11	135	1,743,142	81	1,368,945	54	374,197	5,211,980,139	72,649,369	5,284,629,508
South Atlantic	14	189	2,546,924	97	1,555,643	92	991,281	6,896,678,825	1,330,915,521	8,227,594,346
East South Central	11	134	1,298,424	117	552,972	17	745,452	3,146,850,554	1,147,807,831	4,294,658,385
West South Central	14	289	1,159,102	263	1,141,017	26	18,085	4,252,058,691	828,401,104	5,080,459,795
Mountain	5	91	732,837	17	130,340	74	602,497	3,115,327,130	358,558,881	3,473,886,011
Pacific	17	224	3,309,516	67	1,101,632	157	2,207,884	11,900,607,012	1,735,256,370	13,635,863,382
Canada	**14**	**105**	**2,985,850**	**12**	**70,500**	**93**	**2,915,350**	**16,153,917,571**	**2,010,945,366**	**18,164,862,937**
Mexico	**4**	**23**	**238,756**	**2**	**32,240**	**21**	**206,516**	**921,752,614**	**73,962,000**	**995,714,614**
Railways and Railroads	**15**	**28**	**1,222,737**	**25**	**1,206,037**	**3**	**16,700**	**3,071,212,575**	**1,818,510,064**	**4,889,722,639**

rating only in the East South Central, Mountain and Pacific States.

Table II (Supplement) gives the details and Table IV shows, in summary, what becomes of the output. It happens that the energy purchased (Table III) and sales to other public utilities (Table IV) balance within a fraction of a per cent. Losses and energy used for the business of the reporting companies themselves consume 15.4 per cent of the total (including purchased), or 17.9 per cent of the amount generated.

Deducting these items leaves 66,847,000,000 kw.-hr. to be distributed to ultimate consumers. One-quarter goes to domestic and commercial retail sales, somewhat less of it to the former than to the latter. Five-eighths is sold to wholesale power users. The rest goes to electric railways, electrified railroads, municipalities and miscellaneous sales—agricultural, domestic heating and other.

In general, the relationships shown in Tables IV and V will also apply, approximately, to the industry as a whole, if allowance is made for the difference in character of the companies not included. These smaller establishments, which, as previously stated, generate the remaining 12 per cent of the total energy, will have a larger part of their output go into retail sales. That applies also to most of those operating exclusively on purchased power.

Aside from municipalities, railways and other public utilities this survey accounts for 18,538,000 consumers out of a national total of 24,257,000. The average consumption for all residential customers is 492 kw.-hr. annually and for retail commercial users 3,375 kw.-hr. Thus the latter take, in the average, more than six times as much energy as the average home. Regional averages vary. The highest are found in the West. Some of the regional averages are no doubt appreciably affected by certain peculiarities in the statistics themselves. Thus in the South Atlantic States the retail sales of many mill villages do not appear, although they get their energy from a large system. It is purchased at wholesale, and is so reported, distribution being a local matter. If, instead, the retail business were done by the power company the sales per customer in the geographical region concerned would presumably be lowered.

Canada, Mexico and railways

Canada is again represented by fourteen companies, with a generated output of 16,153,917,571 kw.-hr. against 14,570,390,323 for 1928, a rise of 11 per cent. Corresponding totals, including energy purchased, were 18,164,862,937 and 16,829,464,576 kw.-hr., respectively. The great Ontario "Hydro," second in output only to New York's Niagara Hudson, heads the list. Data on allocation are not as complete as those for the United States and no national averages have been worked out.

Mexico adds one system, making four in all. With purchased energy the output just misses 1,000,000,000 kw.-hr. Most of the increase from 889,351,475 kw.-hr. in 1928 is due to the addition. Water power predominates in both Canada and Mexico (Table III).

Energy for electric railways and electrified railroads was made to include also energy for company-operated railways, when the returns permitted segregation. Some was apparently reported under "Intra-company use."

*Table IV—Allocation of Output of 137 Systems in the United States**

Class of Service	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales
Residential	7,561	7.98	11.30
Commercial retail	9,184	9.71	13.73
Commercial wholesale	41,752	44.10	62.48
Municipal	2,230	2.35	3.34
Other sales	971	1.03	1.45
Railway	5,149	5.43	7.70
Sales, ultimate consumers	66,847	70.60	100.00
Other public utilities	13,290	14.01	.....
Intra-company business	1,395	1.47	.....
Losses	13,199	13.92	.....
Total	94,731	100.00	.....

* In a few returns the allocation was incomplete and estimates had to be used. The effect on the results is negligible.

Table V—Average Kilowatt-Hours per Customer, 137 Large Systems

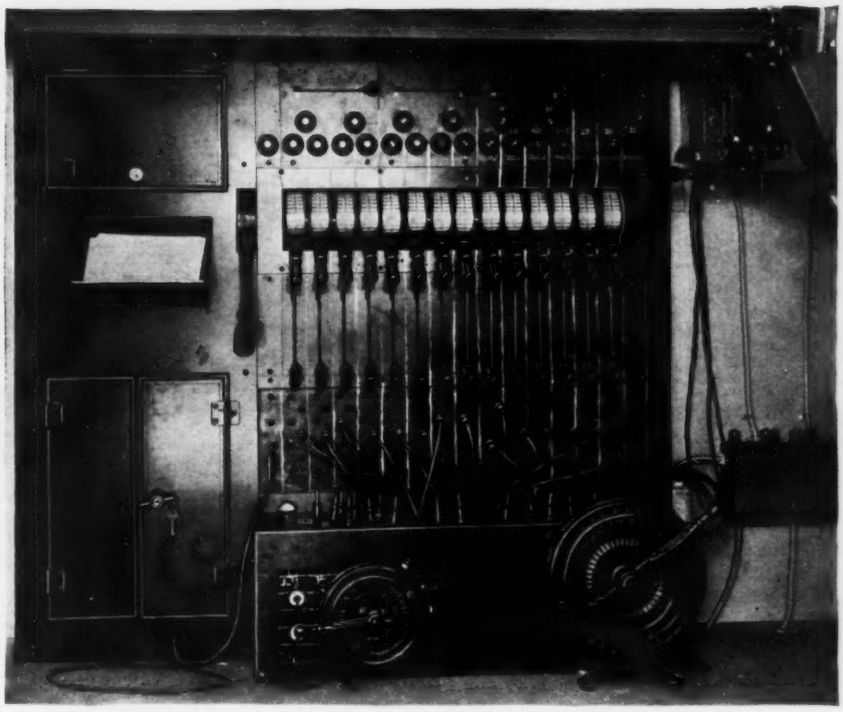
Geographical Region	Residential	Commercial (Retail)
United States	**492**	**3,375**
New England	415	2,895
Middle Atlantic	441	2,820
East North Central	526	3,840
West North Central	501	3,158
South Atlantic	520	3,490
East South Central	440	2,600
West South Central	415	2,062
Mountain	556	2,980
Pacific	635	5,300

Number of Customers

Domestic	15,363,715
Commercial (retail)	2,713,658
Commercial (wholesale)	460,628
	18,538,001

Smith Promotes Stage Lighting

By S. A. ELIOT, JR.
Associate Professor of Drama at Smith College



Front of Smith switchboard

The section at the left contains the main switch, cue sheet board and master switch handle, with fuse magazines above and below. The right section from the top down contains three group master switches, 22 plug fuses, 14 dimmer handles (calibrated from 1 to 10), 14 transfer switches, 120 receptacles, 39 circuit-ends in a horizontal panel like telephone jacks, two 3-way switches with pilot lamps and two dimmers to control these. The actual dimensions of the board are, height, 50 in.; width, 53 in. The operator can reach his post in less than 30 seconds after leaving the stage, and communicates by speaking tube with the stage manager.

THE rapid growth of the art of lighting theatrical productions has depended less upon progress in lamp equipment than upon contrivances invented to control from a single center the intensities, colors and forms of beams utilized by the stage. There yet remains a vast amount of research before the operator of any central type of control board can play upon his instrument unassisted and light a performance without first having to place, focus, color and connect every spotlight which he uses. But while this work goes forward, control boards in use are improving, and some of the latest developments are both interesting and significant. Let us consider some of the problems involved in the design of the control for the Smith College Theater and their bearing upon electrical service to the stage in general.

Three objections have been made to placing the operator in front of the proscenium arch: (1) That he cannot "set" the lighting prior to the rise of the curtain; (2) that he is out of touch with back-stage activities, and (3) that switchboard controls cannot be grouped closely enough to enable the operator to reach the most remote handles while still viewing the scene. *Per contra*, the central control point may be made quickly accessible, or assistants can handle the work while intermissions are on; telephonic or tube communication with the stage manager from a central point is less distracting than back-stage haps and mishaps, and finally, it is possible to compress the usual switchboard to a remarkable extent and design it for an operator whose attention is mainly upon his results and not upon the mechanism. The most advantageous point is under the center front of the stage, with the operator's eyes upon a level with the stage floor and his head concealed by a hood like the opera prompter's.

Operator's reach fixes dimensions

In several particulars the central board must differ from the ordinary stage switchboard. It is limited in height; if the operator's eyes are, say, 5.5 ft. above his platform, then all the control handles must be between 2 ft. and 5.5 ft. above it. As to width, the board cannot have outside handles over 6 ft. apart. Now considering fuse magazines, switch and dimmer handles, pilot lights, etc., as well as the ventilation needed by dimmers if not for humans, how many circuits can be controlled within these space limitations?

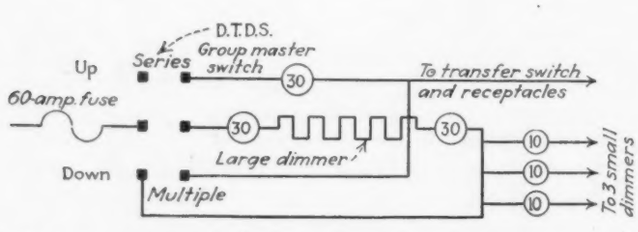
The under side of the stage floor must be sheathed with metal or asbestos to protect the planks against hot air, from the dimmers, and the whole rear of the switchboard, instead of the top, must be open. Incidentally this renders the wiring more accessible. Dimmers cannot be closer together than 4 in. on centers, but two banks can be provided with control by handles on one shaft, 14 or 15 in. below the stage, and possibly a third bank extending below the operator's seat level. Assuming two banks, we have a handle for every 2 in. of

lateral space, and 25 to 30 dimmers can be placed if one is willing to sacrifice so much space.

If the stage is of moderate size, fewer dimmers will suffice. By avoiding the mistake of permanently connecting particular circuits to particular dimmers, using dimmers of dual capacity and providing plenty of undimmable receptacles for circuits needing no dimming, one can get along famously with about fifteen dimmers. Below each dimmer handle there must be receptacles into which any circuit with a wattage within the dimmer capacity can be plugged. The lights on that circuit then get their energy through that dimmer and are controlled as to intensity by that handle. Dual capacity dimmers can be obtained in five sizes with the following service ranges: 250 to 500 watts; 500 to 1,000; 750 to 1,000; 1,000 to 2,000 and 1,500 to 3,000. Their only drawback is that when their maximum loads are plugged in the lights are blacked out when the dimmer handle is half down. There is less range between bright and dark, but their use doubles the flexibility of the board.

Automatic restoration of circuit ends

The most convenient arrangement of circuit ends for plugging into receptacles is the telephone jack idea, weighting each and identifying with the proper circuit symbol and wattage capacity. Forty or 50 plugs can be accommodated in a compact space, and only huge stages need more separate circuits than this. Sockets for plug fuses can be put above each dimmer handle, serving visibility and convenience. The largest dimmers will be protected by 30-amp fuses, the smallest by 6-amp., and these amperages should be painted on the board's face above each socket. The undimmable receptacles in the board should have 30-amp fuses. Only the main



Wiring scheme of McCandless group master switch

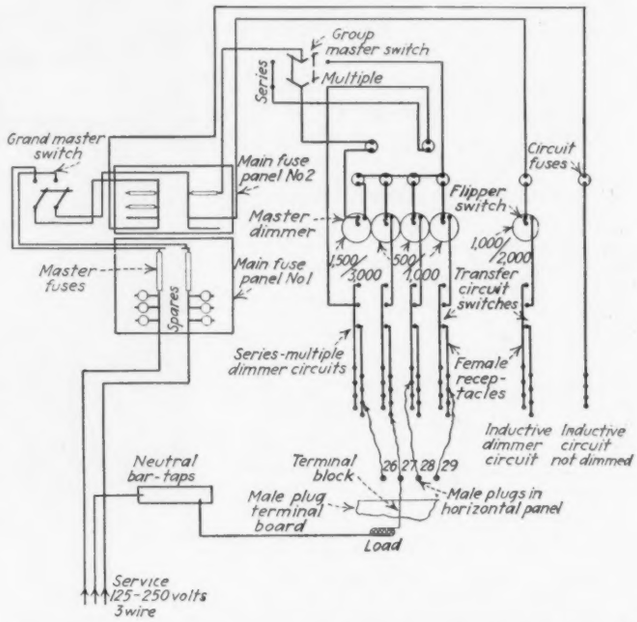
When the switch feeds the "multiple side," current reaches the three small dimmers before passing through the larger one. It only reaches the receptacles of the latter by passing through the second pole of the switch. In feeding the "series" side, energy flows direct to these receptacles, which are thereby made undimmably alive, and branches off through the second pole of the switch to feed the large dimmer before reaching the three small ones. These smaller dimmers therefore receive as much energy as the large dimmer permits, and no more. The two extra plug fuses are necessitated by the requirement of one fuse on each side of the large dimmer in addition to one between the group master switch and the large dimmer's receptacles

switch needs the protection of cartridge fuses with live parts, safely inclosed in a magazine that may or may not be an integral part of the board. In this magazine may be fuses for circuits not controlled by the stage board.

A convenience on the board's face is a bank of transfer switches below the dimmer handles, by which the energy coming through each dimmer can be shunted from one row of receptacles to another. This enables light groups for two acts to be plugged in ahead of time for immediate service without the usual extraction and insertion of plugs between acts. By using a long-bladed knife switch pivoted 6 in. or more back of the board's face and traversing an angle of only 48 deg. between upper and lower jaws one can reduce the vertical space needed by these switch handles to 6 or 7 in. inside and 5 in. outside. Pilot lamps in dimmer circuits are not worth their space on an under-stage board.

Series-multiple group master switch

S. R. McCandless of Yale University has developed a very useful series-multiple switch which makes possible the simultaneous dimming on a single master dimmer of



Typical wiring scheme for Smith stage switchboard

Single-phase, 125-250-volt, three-wire service with solid neutral is used.

three or four colors in the proportion in which they have been mixed, each on its own dimmer. There is generally room for this equipment between the line of plug fuses above the dimmer handles and the stage floor.

In using this switch, for instance, dimmers are first arranged so that, say, three of 1,000 watts maximum rating are next to one of 3,000 watts. The group master switch is of the double-throw, double-pole type, protected by a 60-amp. cartridge fuse. Above the four fuses of the dimmers are inserted two other fuse sockets and a 6-in. slot for the master switch handle.

Such, then, are the major electrical points considered in the design of the switchboard for Smith College Theater. The board was designed at Yale and is only about 4 ft. square. It is located under the stage front, where every detail of the performance is visible to the operator, and yet it controls 44 circuits provided with a total of 145 outlets. The stage here is 44 ft. wide and 17 ft. 10 in. deep, the proscenium arch being 23 ft. 4 in. wide and 13 ft. 7 in. high. The height to the gridiron is 26 ft. It was built by the Trumbull Electric Manufacturing Company, Plainville, Conn., and cost but $2,105. The sole fault found with it after over a year's

operation is that it needs more dimmers of the largest and smallest capacity rating and fewer of the 500 to 1,000-watt rating. House lighting is controlled by dimmers mounted apart from the board, and this has worked out well.

Superiorities of the Smith design

The general design of this board was based upon the one at Yale.* In the opinion of the designer and operator the Smith board surpasses the Yale board in the following particulars:

1. Its location; the operator sees everything visible to the audience and most of the lights as well.
2. Its horizontal panel of circuit ends, automatically falling back when pulled out of receptacles. Yale's circuit ends are countersunk in the face of the board near the floor, requiring jumpers with two types of plug for dimmer connection.
3. Dual capacity dimmers, the Yale board has no flexibility of wattage.
4. Plug fuses on the board face, where a blowout can be instantly seen.
5. Location of group master switches horizontally above each group of dimmers.
6. Its logical, simple and easily taught wiring.
7. The simple transfer switches used, without angle-blades or any "neutral point." Yale's circuits are kept open by these switches at neutral, whereas Smith uses the flipper switches on the dimmer plates, keeping dimmer handles down.
8. Better calibrations on the dimmer handles.
9. Eight receptacles per dimmer instead of Yale's two. Yale also uses a supplementary plugging block to feed more than one circuit at a time through a dimmer.
10. Its eight undimmable receptacles. Yale has practically none of these.

At a recent dance recital ten different numbers were "accompanied" by ten totally different, ever-shifting color patterns on the white plaster sky. Only the absence of definite forms for the colors kept this inferior to a Clavilux performance. The expression and conveyance of emotion through the control of lighting color and intensity is within the seeing lighting-artist's reach.

Described in Theodore Fuch's "Stage Lighting," pages 356-366.

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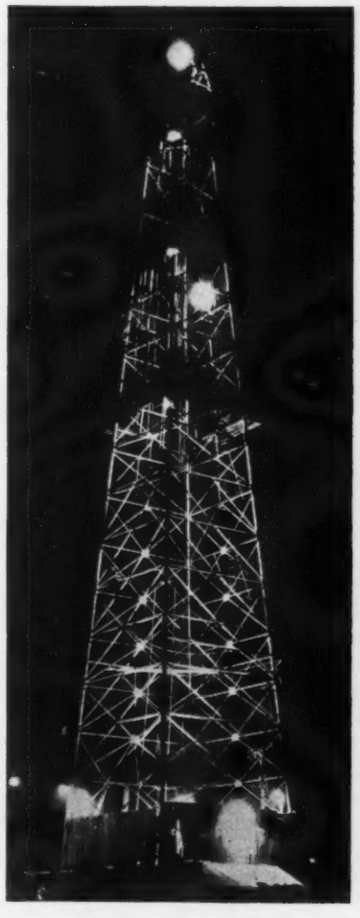
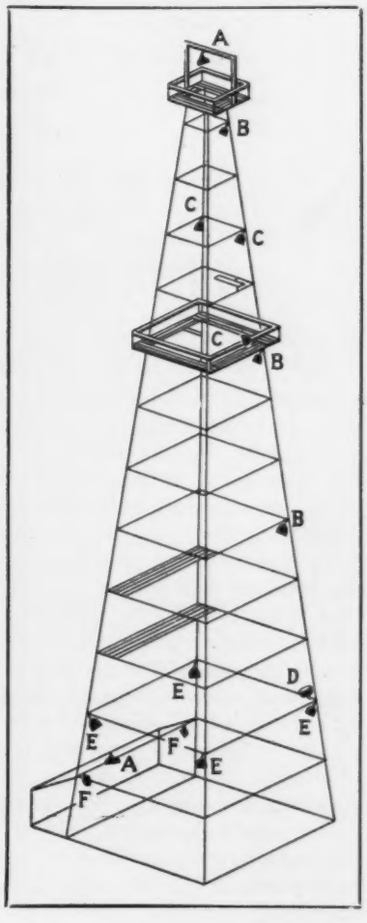
Lighting Oil Derricks on Planned Economies

OIL FIELD operations are carried on 24 hours a day, but the benefits which may be realized by the oil companies through adequate artificial lighting for derricks and general operations have been neglected to an amazing degree. Engineers for the Associated Oil Company and the Southern California Edison Company have worked out a system of lighting which is now used on many of the properties of the former organization.

In planning the wiring system, three circuits are provided, each controlled by a switch with a master switch on the feeder circuit. This makes it possible to economize on the amount of equipment used. When drilling operations have been completed, the circuit feeding the lamps used in lighting the derrick floor is left intact and in operation, while the other equipment, such as switches, reflectors and lamps used on the two remaining circuits, may be taken down and moved to the next drilling job.

The accompanying illustrations give the new lighting layout and show a night view of a derrick with the new lighting system.





California sunshine must be supplemented by electric lights in the oil fields

A—100-watt lamp in vapor-proof R.L.M. reflector (such as Benjamin V.P. dome reflector No. 6501).

B—200-watt lamp in vapor-proof deep-bowl reflector (such as Benjamin V.P. bowl reflector No. 6507).

C—150-watt lamp in vapor-proof deep-bowl reflector (such as Benjamin V.P. bowl reflector No. 6506).

D—500-watt P.S.-40 clear lamp in flood-lighting projector having a narrow beam and weatherproof construction (such as Crouse-Hinds L.C. A.-16 projector equipped with a diffusing cover glass and a smooth reflector).

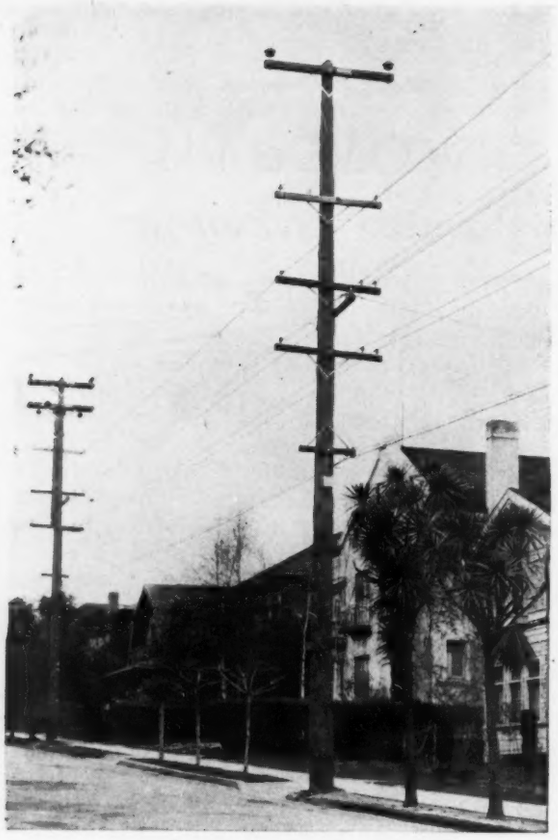
E—500-watt lamp in vapor-proof deep-bowl reflector (such as Benjamin V.P. bowl reflector No. 6508) and mounted about 22 ft. above derrick floor.

F—150-watt lamp in vapor-proof angle reflector (such as Benjamin V.P. symmetrical angle reflector No. 6510).

What the Engineer Can Do to Reduce D

By S. BINGHAM HOOD

Development and Research Engineer, San Leandro, Calif.



An example of high pole joint street construction where 11-kv. primary is used

NO PLEA is here to be made for the distribution system. In far too many instances it is a disgrace to the engineering profession and built apparently more as a monument to the design and methods of the days of Morse and Graham Bell than it is to those of modern engineering economics. Some time within the next decade the writer looks for many very marked changes in distribution system design and methods. Changes that will be along the lines of true engineering, with precedent relegated to the museum, where it more properly belongs. Such changes, however, will be along the same lines, in their ultimate effect on cost of energy to the average customer, as have been those in major generating and transmission developments.

In justice to the distribution engineer and to indicate the problem that confronts him it should be pointed out that even though he reduced unit costs from, say, a figure of $150 per kilowatt of demand by one-half, it would mean that the average consumer with a 250-watt integrated system demand would have his bill reduced by only about 67 cents per month. Such a reduction is a far cry from one that will bring electric service down to the point where it is not "too expensive." Notwithstanding this, the distribution engineer should not throw up his hands in despair. He has problems that challenge his ingenuity and best efforts and has before him an opportunity to do for the distribution system what has been done in other branches of utility engineering.

Much remains to be done in the way of planning for the future by preliminary studies and in the improvement in design of distribution systems. There are few systems in the country that have been built according to a preconceived plan. They just grew up like Topsy, and there are fewer still that bear evidence of concentrated thought on problems of design.

After many years' intensive national co-operative effort materials used in overhead line construction have been very largely standardized. Unfortunately, however, methods of construction have by no means received equal consideration. The result has been, as one can well realize, that methods that for one utility, or one locality, have so thoroughly justified themselves that they have become standard for that section are looked upon as radical departures from what has been classed as standard in another section, and for that reason, and that alone, to be fought shy of.

Regardless of this lack of uniformity in methods, or perhaps, more properly speaking, system design, overhead construction today is generally far superior to that of fifteen or twenty years ago. Then distribution lines were good for at best about ten years of life, with first cost given major consideration. With the growth of utility service such lines quite generally became obsolete at just about the time they started to fall down; in other words, they compared with the celebrated Deacon's one-horse shay.

The average well-constructed line of today is built of high-grade standardized materials with a life expectancy of at least twice that of our line of a decade ago. Unfortunately, the higher inherent cost of these materials, plus the general rise in all commodity prices, makes such a line cost at least double that of the old line. In other words, we have cut our depreciation percentage item at least in half, but by doubling the cost have left the depreciation increment as high as it ever was, and on top of that have doubled the interest element.

Under these unfavorable economic conditions the only solution seems to be in a more economic basic design.

Distribution Costs

Standardization of practice needed. Higher voltages, use of bare wire, common neutral and multiple street lighting offer possibilities for reducing costs

Short pole joint construction on rear property line

Almost every large utility has made somewhat intensive studies of this factor and adopted a local standard of design which to it appeals as ideal, while to others it appears wasteful in the extreme in comparison to what they in turn have selected as their idealistic standard. The spread between the extremes of these so-called standards is so great that to the research engineer it is glaringly evident that the time is ripe for a real unbiased national study of these various methods in order to arrive at some practicable composite design which will in actuality more fully meet the requirements of real rather than imaginary economic solution.

Pole heights from 35 to 60 ft.

Taking the question of poles and their location, we find one utility erecting poles of 35 to 40 ft. in height for joint usage with the communication system. These are located largely in rear alleys or along rear lot line easements. Here the pole cost is not only kept at a minimum but good public relations are fostered by keeping the principal residential streets free of poles, which, at best, are an esthetic blot on the highways of our urban communities.

In contrast to this we find another community, in which the utilities have combined to eliminate unnecessary poles from the streets, using a standard of 55 to 60 ft. for all poles and placing them by preference in the streets. This excessive height is the result of having to provide pole space for two light and power utilities in addition to communication system facilities. The fact that one utility uses an 11-kv. primary system and that state requirements are in excess of those of our national standard, and places the factor of safety, both real and imaginary, ahead of any factor as to esthetics, complicates the situation there.

Economically any advantage to an individual utility through having the pole cost spread over three utilities is nullified by using a standard full-height pole on both major and minor leads so that there can be no possibility of a minor lead growing into the major class and requiring resetting of poles. Here it would appear that from both the standpoint of good engineering as well as public policy it has been overlooked that in the last analysis it is the public that must pay, and that the general feeling of the public toward its utilities is far less favorable than in the case first mentioned.

Primary distribution from 2.3 to 16 kv.

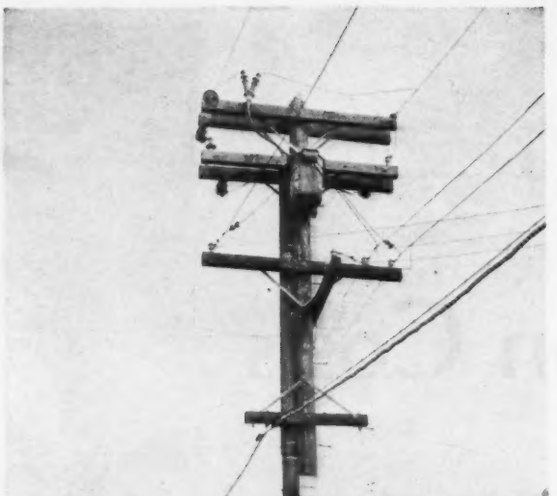
Taking primary distribution systems, we find all voltages from 2.3 kv. to 16 kv. in quite general use, with a strong tendency to use the 4-kv., three-phase, four-wire as a standard. This latter system is in many instances being further simplified and improved as to reliability and safety by adopting the common neutral principle which eliminates the fourth wire and therefore takes on the physical characteristic of the older 2.3-kv., three-wire system with the economic advantages of 4 kv.

Other utilities are adopting various other higher voltages with claimed, but not always proved, economic advantages. One large system has gone in extensively for a composite system using a maximum of 8 kv. This is a four-wire system with a common neutral as the fourth wire where conditions are favorable. Liberal use of low-cost auto-transformers is made to change from 4 to 8 kv., or vice versa, while the distribution transformers all have two coils and taps so they can be used interchangeably on any primary voltage or any scheme of connection between 2.3 kv. and 8 kv. Another large system has

changed over to a 4.8-kv. delta system, using 4.8-kv. distribution transformers. At some future date it is planned to Y-connect this system to take further advantage of the copper in the system.

Just where the economic and practical limit lies on primary voltage remains to be established by operating experience and reliability at these higher voltages. It is certain, however, that much progress has been made since the days of the old 2.3-kv. system, which in many cases was single-phase for lighting transformers with the third leg run out as a small wire to pick up occasional three-phase power load.

Along with these higher primary voltages has come a change in thought now beginning to be expressed in practice as regards the use of insulated wire. Fabricated weatherproof insulation is of doubtful value, particularly at voltages above 2.3 kv., and in some cases has been eliminated. This has not only lowered costs by that represented by the insulation itself, but at the same time has practically eliminated the factor of depreciation as it applies to primary system conductors.



Combined overhead and underground construction is often the solution to serving high-class residential sections

Lead-covered cable is used to carry the 4-kv. primary across streets.

Taking the low-voltage secondary systems we find the single-phase, three-wire predominating for residential district service. However, the design details of this major item in distribution costs go all the way from the isolated section fed from its own transformer to that of the complete interconnected network or grid with transformers feeding in at numerous points. Even where the basically economical grid or network system is used innumerable methods for insuring continuity of operation are used. In some instances everything is tied in solid and the burning off factor depended upon for protection. Others split up into the usual small isolated sections and interconnect these sections through fuses.

Variable wire size in secondary systems

In one instance where a network is used the standard conductor size is No. 4 for the outside legs with a No. 6 for the neutral. Transformers are varied as to size and location to suit the load demands as they exist or materialize, in that way offsetting any factor of obsolescence through growth of load density. In another instance No. 00 conductors have been selected as standard for both outer and neutral secondary with transformers of as large capacity as mechanically practicable and their loading controlled by varying their spacing. Here we see two extremes of standardization, both giving substantially equal quality of service to the consumer.

In the mechanical arrangement of secondary conductors some localities use vertical racks exclusively, confining the use of the unsightly crossarm to the higher voltage conductors. In other localities crossarms are used exclusively for both high- and low-voltage conductors with an additional service buckarm on every pole where services are or may be taken off. Irrespective of the economic factors as between racks and crossarms, the more important factor of esthetics as it reacts on public relations should govern far more than it does. In still other cases we find fabricated insulation being eliminated from the low-voltage secondary mains as well as from the primary. The essential electrical separation between conductors is in such cases assured by using increased conductor spacing, together with medium hard-drawn wire that can be strung with less sag. In such applications the cost of the fabricated insulation is eliminated, the poles have less loading to carry and depreciation of conductors is practically eliminated. The possibilities here are so pronounced that an intensive unbiased national investigation is most clearly justified.

Series street lighting obsolete

In the realms of street lighting the old original series system is still the favorite where precedent rules. This system involves not only gross duplication of wire plant but also the use of innumerable "safety gadgets" that not only further lower its inherent inefficiency but make its first cost top-heavy. Just why this system has persisted is one of the mysteries of modern utility progress. The inherent losses between substation bus and lamp output aggregate approximately 25 per cent. The operating cost, as shown by several authentic operating records, is likewise about 25 per cent higher than a low-voltage multiple system using the same lamps and rendering the same standard of service as that received by all other lighting customers.

The low-voltage multiple system requires no duplica-

tion of wire plant, its load can be absorbed by the diversity on the existing low-voltage network, it involves negligible energy losses and it can be remotely controlled by a simple low-voltage relay system. Compared to a typical series system it can be installed at between 15 and 40 per cent less investment. It will give 10 per cent less maintained candlepower than will a series system of the same initial lamp rating, provided the constant current is maintained at normal rating just as must be the constant voltage of a multiple system serving both street lamps and lighting consumers from the same mains.

The point that should be given intensive study is whether all the complications and undesirable inherent factors of a series system which at best gives 10 per cent better maintained lighting at the expense of 25 per cent increased energy consumption is worth while. Such cities as New York, Minneapolis, New Orleans, Toronto and Seattle have most conclusively satisfied themselves that the low-voltage multiple system is the best. Who is to decide whether they are right or whether Los Angeles and San Francisco, as examples of a host of others, are right in placing on the shoulders of their publics a burden of millions of dollars in excess investment that those who have been converted to the multiple system would class as an unjustified economic waste?

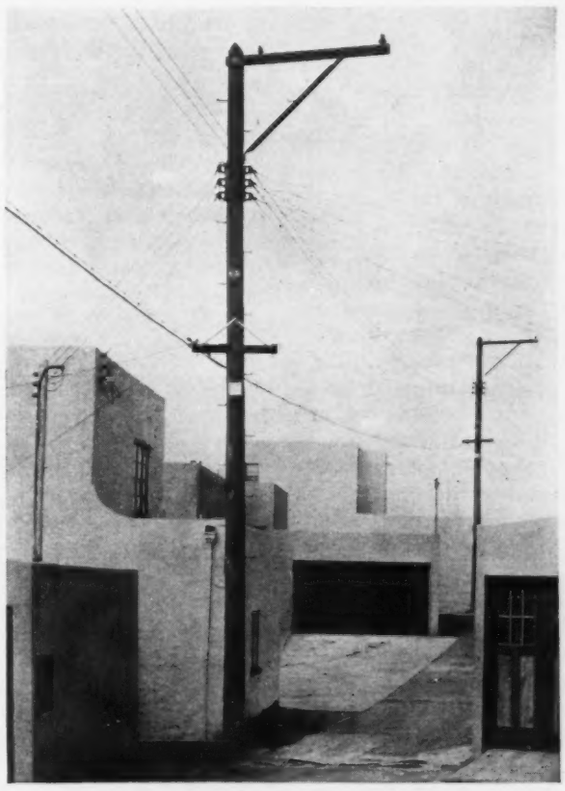
We cannot expect our manufacturers to decide for us. They have spent large sums in developing series circuit auxiliary equipment to meet real or fancied needs. The selection of a multiple system substitutes for this series system equipment demand one for multiple-circuit equipment which is already developed and sold in a highly competitive market for application in ordinary commercial lighting. The lamp manufacturers have perhaps unwittingly perpetuated the series system in rating series lamps in lumens as against multiple lamps in watts and not making lamp sizes in both classes which can be matched up. For instance, if a municipality specifies a 400-cp. or 4,000-lumen lamp that specification can only be filled by using a series system, since the nearest multiple lamp is 200 watts, giving 320 cp., or 300 watts, giving 520 cp. Similar disparity exists in all the other sizes of lamps.

Touching briefly on underground construction, discussion will be confined to those cases where the public attitude is forcing supply mains of comparatively low load density underground, as in high-class residential districts. Leaving out those cases where more attention to esthetic factors in design would have made overhead construction acceptable, we find underground construction prohibitively expensive because it is made so by loading it up with unessential burdens.

In many cases very extensive territories have been served by laying ordinary lead-covered cables directly in the earth, thus saving all the conduit cost, which is a major item in standard construction. These installations have, without exception, justified their adoption through years of satisfactory service. In one instance several hundred miles of such construction has been laid along rural highways at a cost which it is claimed was lower than it would have been for good overhead construction. In another instance a high-class residential subdivision of more than 500 lots was put in with solid underground at a cost of only approximately $8,000 over that of an overhead system. Certainly $16 per lot is not an excessive cost to put on complete underground residential service, which incidentally also included underground supply to ornamental street-lighting standards. In another instance underground supply to street lamps whose location would otherwise have required poles for that class of service only was installed (for a multiple remote control system) at considerably lower cost than for overhead construction. Moreover, the public's fur was not rubbed the wrong way.

The answer here is that again precedent has governed in too many cases of prohibitive cost as to underground construction, while those systems that have justified themselves as to low first cost as well as service reliability are left to carry the stigma of radicalism.

In considering changes in distribution practice, either in design or method of application, minor savings should not be passed over as being so small as not to be worth while. Cutting a dollar off the cost of serving a residential customer only reduces his bill by 1 cent per month, but if we cut a dollar off the cost to serve each of the 20,000,000 residential customers we save $20,000,000. If each and every man in the utility business, be he major executive or minor departmental head, will keep this thought in mind of saving the pennies he will be too busy to "pass the buck" to the other fellow who can save dollars.



Racked secondary construction eliminates both line-arms and buck-arms

READERS' FORUM

Seeking Weatherproof Clothes for Linemen

To the Editor of the ELECTRICAL WORLD:

We are experiencing difficulty in finding clothes suitable for our linemen while working in heavy rains such as frequently occur in our country.

Possibly American power companies have devised suitable outfits, as the climatic conditions in some of their territories are more severe than ours.

We would appreciate it if any of them will assist us in getting in touch with outfitters catering to them.

T. H. VAJURO.

The Jaffa Electric Company, Ltd.,
Tel-Aviv, Palestine.

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Contends Criticism Not Unjustified

To the Editor of the ELECTRICAL WORLD:

There is a lot of truth in what William Van Alen says in his article on "Co-operation as One Architect Sees It" in the March 15 issue, but there is something to be said on the other side. In the first place, the average high-class architect has a broader viewpoint than most lighting men with whom he comes in contact. Generally speaking, just as he says, the men who contact the architect are salesmen for some particular device and are not always well posted on what that will do. Some are not competent to help him with his big, broad problem, or even to furnish specific technical information. The answer is that the electrical industry should have higher caliber men contacting with the architect. In a few instances, for example, certain large fixture manufacturers have some really qualified individuals doing this work and they do obtain the confidence of the architect.

Many young central-station engineers have very little concept of the artistic side of the problem and they are just as likely to try to light a monumental building with commercial fixtures. One often says, thank goodness the *average* lighting man doesn't get the chance of lighting our best buildings! In spite of all the architect's limitations and his lack of technical knowledge of lighting, he does a better job because he has a broader picture and much more feeling for the fitness of things.

In my opinion the architect should conceive the proposition as a whole, should visualize the effect he is desirous of creating, and should sketch up the general type of fixture or arrangement of lighting that he has in mind. Then the lighting expert should come in and show him where by certain modifications, the addition of reflecting equipment, the use of a proper size of lamp, etc., he can make his scheme more practical.

Occasionally the architect conceives something that is almost impossible of achievement or totally impractical. It so happens that in one particular building the architect initially conceived an idea that could not have been applied. For example, he wanted to use very dense marble as a diffusing media and had practically no space in which to place lamps. With the material he proposed using high-wattage equipment for which there was no room.

Unfortunately, there are many salesmen posing as "lighting experts," and they do much to depreciate the really qualified men in the eyes of the architect. If the architect contracted with men in the lighting business who, relatively speaking, were as good in their own line as he is in his, I am sure he would have no cause for complaint and would receive the help he is looking for.

What Mr. Van Alen says about the so-called lighting experts wanting to do things as they have always been done, or with variations, is in line with what is said above about the inexperienced man trying to use standard equipment where very special equipment is required.

AN ILLUMINATING ENGINEER.

[This comment was submitted in confidence because the author did not care to have his business relationships hampered, but is being published anonymously because situations can be rectified only when all contributory factors are known.—EDITOR.]

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Welding Not Standard in Power Plant Piping

To the Editor of the ELECTRICAL WORLD:

At the bottom of page 404 in the February 22 issue of ELECTRICAL WORLD are shown two pictures illustrating electric welding, and under them appears the following statement:

"Eighty arc-welding machines are used in fabricating virtually all the pipe work installed by the Detroit Edison Company. Here are two samples of pipe welding done by this process, which has a wide range of possible use and value in all industries. C. I. Goudey, construction estimator for the company, related the extent to which welding is used in the December 28, 1929, issue of ELECTRICAL WORLD and presented unit cost comparisons."

The Detroit Edison Company does not use welding in virtually all of the pipe work installed. As a matter of fact, we use a rather small percentage of welding on power plant piping, and at the present time are unwilling to consider welding construction on any high-pressure steam or water piping. The thought conveyed in the published statement is liable to create a false idea of our standard practice.

PAUL W. THOMPSON,
Chief Assistant Engineer of Power Plants.

Detroit Edison Company,
Detroit, Mich.

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Secondary Power Supplying Electric Boilers

To the Editor of the ELECTRICAL WORLD:

Answering Mr. Showalter's question in your Readers' Forum of the March 29 issue, it might be interesting to know that many large Canadian hydro-electric companies are successfully disposing of their secondary power by means of electric boilers. This especially applies to pulp and paper mill operation, where many millions of kilowatt-hours are consumed each month.

N. D. PAINE.

Price Brothers & Company Ltd.,
Hydro-Electric Department, Kenogami, P. Q., Canada.

Men of the Industry

H. E. Cox Named President Southeastern Division

H. E. Cox, who was elected president of the Southeastern Division of the National Electric Light Association, has been affiliated with the Birmingham Electric and predecessor companies since 1911. At the present time he is occupying the position of assistant general manager. A native of Alabama and a

graduate of the Alabama Polytechnic Institute, Mr. Cox was connected for a time with the General Electric Company. After he entered the employ of the old Birmingham Railway, Light & Power Company he was assigned to the operating and construction department. Subsequently he was named assistant chief engineer and later chief engineer. He assumed the duties of his present position in the fall of 1925.

Mr. Cox has been active in association work, having served for several years on the executive committee of the Southeastern Division and last year as vice-president.

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C. P. COUCH, vice-president and general manager of the Southern Ice & Utilities Company, Dallas, has resigned to become vice-president in charge of operations of the Louisiana & Arkansas Railway Company with headquarters at Shreveport. Before going with Southern Ice & Utilities several years ago, Mr. Couch was vice-president and general manager of the Mississippi Power & Light Company, with headquarters at Jackson, and while in this position he developed an interconnected system supplying electric power to more than 100 cities and towns of Mississippi hitherto dependent upon isolated plants of small capacity. In association with his brother, H. C. Couch, president of the Arkansas, Louisiana and Mississippi power and light companies and of the Louisiana & Arkansas Railway Company, he had a large part in developing the interconnected power systems of these companies.

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ISAAC S. HALL, the newly elected treasurer of Charles H. Tenney & Company, Boston, was educated at Yale University and entered the organization's service as a bookkeeper in 1909 for the Malden Electric Company. He was transferred to the parent company as office manager in 1912 and later became auditor and comptroller. In 1922 he was elected a vice-president, which title he retains.

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ORLANDO B. SWIFT has been appointed assistant to the president and general manager of the Lowell (Mass.) Electric Light Corporation, with the authority, duties and responsibilities lately exercised by Louis S. Leavitt, who has been transferred from the managership of the Lowell company to become assistant to the vice-president and general manager of the Worcester (Mass.) Electric Light Company. Mr. Swift has been in the employ of the Lowell company for the past five years and has served in the engineering, sales and executive branches of its work.

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P. S. HOPKINS has resigned his position as general manager of the Standard Oil Company of New York (North China department) to take charge of the Chinese interests of the American & Foreign Power Company, whose subsidiary, the Shanghai Power Company, acquired last year the municipal electricity department of Shanghai. Born in Peking, China, Mr. Hopkins was educated in the United States, graduating from the Massachusetts Institute of Technology with the degree of B.S. in mining engineering. As part of his duties with the American & Foreign Power Company Mr. Hopkins will become president of the Shanghai Power Company and chairman of its advisory board.

R. C. Tenney New President of Tenney Company

ROCKWELL C. TENNEY, whose election to the presidency of Charles H. Tenney & Company, Boston, Mass., has recently been announced, entered the public utility field in 1916, following preliminary training in banking houses at Springfield, Mass., and Hartford, Conn. After a year's service in the investment depart-

ment of the Tenney organization at Boston he spent three years in the Quartermaster's Corps and Ordnance Department of the U. S. Army, returning to the Tenney company in 1919. After a short term in the new-business department he was elected assistant treasurer in 1920 and treasurer later in the year. Early in 1929 he was also made a vice-president of the company. Mr. Tenney is a director in sixteen public utility companies and is president and director of the Teneco Sales Corporation.

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LUIGI EMANUELI has been appointed to succeed the late Signor Guido Semenza as honorary secretary for Italy of the Institution of Electrical Engineers (British).

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PAUL J. KRUESI has been elected president of the American Lava Corporation, Chattanooga, Tenn., to succeed the late John Kruesi, his brother. Paul Kruesi was the founder of the American

Lava Corporation and in the course of his career has established a national reputation among manufacturers. At the present time he is also president of the Southern Ferro-Alloys Company. Mr. Kruesi is a past-president of the American Electro-chemical Society.

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A. W. HIGGINS, formerly executive vice-president of the Seaboard Public Service Company, Alexandria, Va., is now president of that organization. Mr. Higgins is succeeding Harry Reid, who was elected vice-chairman of the company. George E. Warfield of Alexandria, Va., and Lewis Payne, vice-president and general manager of the Virginia Public Service Company, have been added to the board of directors.

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R. H. DEARBORN, professor of electrical engineering at the Oregon State College, has been elected a fellow of the American Institute of Electrical Engineers. The professor received the honor as a professor of electrical engineering who has attained special distinction as expounder of the principles of electrical engineering in accordance with the constitution of the institute.

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C. B. HAYES, formerly district superintendent of the Florida Public Service Company, with headquarters in Orlando, has been promoted to general manager of the American Utilities Company, with headquarters at Lafayette, La. He was formerly district superintendent at Lake Wales and was later transferred to Orlando as district superintendent of the Orlando division. He has been connected with the public utility field since 1905, when he went with the Ice & Power Company at Lake Wales. When this company was taken over by Florida Public Service Company in February, 1924, he was made district superintendent.

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W. B. GESELL, who is connected with the rate department of the Byllesby organization in Chicago, as a rate engineer, is organizing a new rate department for the Oklahoma Gas & Electric Company. The new department will take over the rate work, which formerly has centered in the commercial and legal departments. Mr. Gesell has been engaged in public utility work since his graduation from the University of Wisconsin. Early in his career he was connected with the Milwaukee Electric Railway & Light Company and subsequently with the Railroad Commission of Wisconsin. It was following this connection that he joined the Byllesby organization in Chicago.

Harry E. Duren Heads New England Division

HARRY E. DUREN, who was elected president of the New England Division of the National Electric Light Association on April 24 for the year beginning July 1, has had a varied experience in the manufacturing and central-station fields and is prominent among the younger operating executives of the northeast for his work in commercial and public relations. A biographical sketch of Mr. Duren was published in the ELECTRICAL WORLD, December 28, 1929, page 1296, following his election to the vice-presidency of the Greenfield

(Mass.) Electric Light & Power Company, an affiliated property in the group controlled by the Western Massachusetts Companies. His earlier record includes service with the General Electric Company at Schenectady and on the Pacific Coast. Fifteen years ago he became associated with the Newburyport (Mass.) Gas & Electric Light Company, later being employed by the power companies at Greenfield and Fall River, Mass., and becoming manager of the Greenfield company nine years ago. Mr. Duren's interests have covered both engineering and economic phases of utility work and he has been particularly successful in the development of excellent trade relations in the territories which his companies have served.

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C. B. COURSER, formerly general manager of the American Utilities Company, which was recently purchased by the Associated Gas & Electric Company, has succeeded G. C. Hyde as general manager of the Florida Public Service Company, with headquarters at Orlando. Mr. Hyde has been named vice-president and general manager of the Southern Ice & Utilities Company, which was also recently purchased by the Associated System. Mr. Hyde's headquarters will be in Dallas. Mr. Courser, before going to Lafayette, La., as general manager of the American Utilities Company, was general manager of the Kentucky-Tennessee Light & Power Company, also a part of the Associated Gas & Electric System. Mr. Courser has been with the Associated System for some ten years and has been connected in the public utilities field for over twenty years. He is a graduate of the University of New Hampshire.

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S. MURRAY JONES, formerly connected with the Southeastern Engineering Company, is now associated with the engineering department of the Ohio Brass Company, Mansfield, Ohio. Mr. Jones is a graduate of the Massachusetts Institute of Technology and from the time of his graduation in 1922 until 1925 he was employed in the operating and construction departments of the Alabama Power Company. Subsequently he served as relay engineer for the Carolina Power & Light Company.

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OBITUARY

GEORGE A. CARMICHAEL, secretary of the Rhode Island Public Utilities Commission since 1920, died at Belmont, Mass., April 19, at the age of 60. Mr. Carmichael entered the service of the commission in 1912 as a special investigator. His previous career included a term of employment by the New York, New Haven & Hartford Railroad and several years in the investment banking field.

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WILLIAM HENRY BALDWIN, dean of hydraulic and mechanical engineers in Ottawa, Canada, and an outstanding authority on electric power equipment in the district, died in an Ottawa hospital on April 25, at the advanced age of 84 years. Mr. Baldwin was born in 1846 at Ticonderoga, N. Y., but moved to Canada at an early age. After a varied career he took up residence in Ottawa in 1890 and from then on his time was devoted to the development of electricity in the Ottawa district. He assumed charge of the power plants of the Ottawa Electric Company and the Ottawa Electric Railway. Under his direction all the important electrical units of these companies were installed. He retired from active service three years ago, but was retained by the Ottawa Electric Company in an advisory capacity.

Financial and Statistical News

MARKET conditions since the October break have favored senior financing to such an extent that of the total new power and light issues publicly sold since that time approximately 90 per cent comprise bonds, debentures and notes; junior issues represent only 10 per cent.

——THE PERCENTAGES QUOTED EXCLUDE the exercise of rights to purchase common stock and stock sold to customers direct, figures for which are not yet available.

——DEALERS REPORT THAT RECENT UTILITY bond and debenture issues have been distributed more successfully than was anticipated. The bond market showed greater strength and increased activity this week, especially during the latter part of the corrective movement in stocks.

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Customer-Ownership Sales Rise

FEBRUARY SALES OF STOCK sold on the customer-ownership plan amounted to $12,291,000, the number of shares sold was 173,200 and the number of transactions 22,600, it is estimated on the basis of reports received by the ELECTRICAL WORLD from central-station companies selling stock directly to customers, employees and other local parties.

These sales are the largest since October of last year and clearly indicate an upward movement toward the levels of last summer after the smaller sales of November, December and January. January sales consisted of 16,700 transactions, involving 128,400 shares, valued at $9,412,000.

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Few Industries Show Gains, but Electric Is One of Them

REVENUE OF ELECTRIC LIGHT and power companies for March will average about 4 per cent greater in 1930 than in 1929, it is estimated on the basis of incomplete returns thus far received by the ELECTRICAL WORLD. If this rate of increase is confirmed by statistics from those companies that have not yet reported, March will prove to have been a month of less than normal progress; January was up 6 per cent and February 5 per cent. Even at that, the first quarter of the year will show a gain of 5 per cent in 1930 compared 1929. In the present epidemic of corporation reports showing reduced earnings, when the financial columns bloom with special honor rolls for the few that show gains, this continued upward movement of the power industry deserves mention.

Further, the gains were not uniformly small. The average rate of increase for reporting companies in the Middle Atlantic States was higher than that region experienced for March 1928-1929. New England also did fairly well. The only region reporting no gains is the East North Central; probably the 27 per cent drop in power used by the automobile industry goes far toward accounting for that circumstance.

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Montreal Utility to Split Shares

A SPECIAL GENERAL MEETING OF SHAREHOLDERS of the Montreal Light, Heat & Power Consolidated will be held at the head offices of the company on May 7. They will consider the adoption of a resolution, approved by the directors, increasing the authorized capital of the company from 2,558,163 shares without nominal or par value to 5,000,000 shares without nominal or par value. Action will also be taken on subdividing each of the shares of the company, increased as aforesaid, into two shares without nominal or par value.

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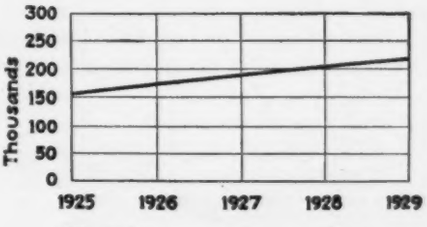
Consolidated Gas Cuts Rates, but Revenue Increases

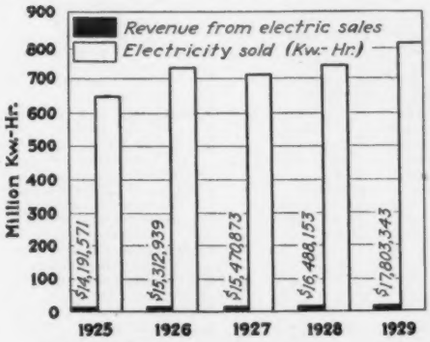
THE year's operations carried on by Consolidated Gas, Electric Light & Power Company of Baltimore provide a more or less typical picture of the growth of the electrical industry in a metropolitan area during 1929. The year's growth has been very gratifying and revenue has increased materially notwithstanding the number of rate reductions.

The company's income account for the year shows a growth of approximately 8 per cent in revenue from electric sales and an increase of 7.24 per cent in total operating revenue. Operating expenses increase by only 4.34 per cent, allowing for an advance of 11.92 per cent in net operating revenue and of 12.7 per cent in net operating and non-operating revenue. Taxes increased by 7.54 per cent and retirement expense by approximately 5 per cent. The operating ratio was reduced from 49.4 per cent in 1928 to 48.1 last year. After fixed charges net income increased by 23.55 per cent and the surplus for the year amounted to $3,359,072, which was an increase of 42.52 per cent.

The growth of electrical business is



Electric customers covering five-year period



Growth in revenue and output since 1925

illustrated by the fact that revenue from electrical sales increased 7.98 per cent, the volume of kilowatt-hours sold increased by 10.32 per cent and the number of customers was 6.27 per cent greater at the end of the year.

The following very interesting comparison was made by the company illustrating the relation between lowered rates and increased consumption and revenue since the end of the war:

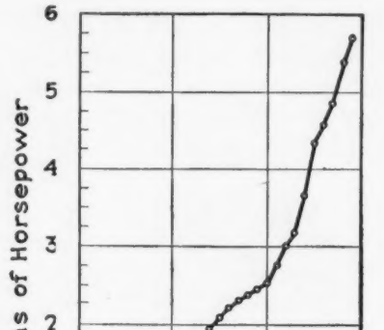
	Average Rate per Kw.-Hr., Cents	Consumption Kw.-Hr. per Customer	Revenue per Customer
1919	7.33	391	$28.65
1928	5.48	545	29.88
1929	5.33	585	31.21

In addition to these reductions another became effective November 1, last, and this will further reduce the average rate for domestic service to well under 5 cents per kilowatt-hour for the year 1930. In the eleven-year period referred to and before this latest rate reduction the domestic service rates have been decreased 26 per cent and the customers were getting 50 per cent more service in 1929 at only 10 per cent more cost. Within the same period the number of domestic consumers increased by 284 per cent and the total annual revenue from such customers increased by 340 per cent.

During the year the company sold a $10,500,000 issue of 4¾ per cent first refunding mortgage bonds and retired an issue of $4,428,000 which had matured. In addition, $1,167,600 was subscribed for by customers and others and further common stock was sold to employees and to shareholders.

Canada's Fast-Growing Water Power

CANADIAN WATER-POWER installations have been increasing at an average rate of 420,000 hp. yearly during the past six years, and in view of the number of large undertakings at present under consideration it seems conservative to predict that this rate will be maintained. In that event the total for the Dominion will have reached 10,300,000 hp. by 1940. This expectation is expressed in a recent paper, presented at the annual general meeting of the Engineering Institute of Canada at Ottawa by N. Marr, chief hydraulic engineer of the Dominion Water Power and Reclamation Service.



Canadian water-power plants
173,323 hp. in 1900; 5,710,802 hp. in 1929

The paper traces the development statistically, by provinces and by years from 1900 to 1929; it contains detailed information regarding some of the more important plants now in operation and outlines possible future developments. Nine regional maps show the location of transmission lines.

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Profit-Sharing Agreement in Houston to Be Revised

REVISION OF THE profit-sharing agreement between the city of Houston and the Houston Lighting & Power Company has been proposed by S. R. Bertron, Jr., president and general manager of the company. The company has asked that changes in the contract be made so that Houston shall share part of the excess profits of the company with the numerous smaller towns and cities surrounding Houston which the Houston Lighting & Power Company serves. During the past few years Houston has received revenues approximating $500,000 from the company under terms of a profit-sharing agreement.

Under terms of the contract, Houston and the company share on a 50-50 basis all excess profits of the company. The company is allowed a return of 8 per cent on its investment, sets aside 4 per cent on its investment annually for depreciation, then all profits above that

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
American Water Works & Electric & subs. (Year ended February 28)					
Gross earnings	$54,538,865	$51,439,063	6.1	50	51
Net earnings	27,227,195	25,353,298	7.4	..	..
Associated Gas & Electric System (Year ended February 28)					
Gross earnings	98,029,223	47,437,778	107	50	55
Net earnings	49,259,659	21,262,938	132	..	..
Carolina Power & Light (Year ended February 28)					
Gross earnings	9,226,386	9,081,603	2.0	46	47
Net earnings	4,983,691	4,827,917	3.0	..	..
Central Illinois Light (Year ended March 31)					
Gross earnings	5,205,233	4,853,179	7.3	58	58
Net earnings	2,211,813	1,996,400	10.8	..	..
Cities Service (Year ended March 31)					
Gross earnings	50,907,115	36,179,356	41	..	..
Net earnings	49,399,536	34,997,691	41	..	..
Commonwealth & Southern & subs. (Year ended March 31)					
Gross earnings	147,482,033	139,870,696	5.5	49	51
Net earnings	75,430,775	70,907,080	6.4	.	..
Consumers Power (Year ended March 31)					
Gross earnings	33,339,669	31,436,851	6.0	48	49
Net earnings	17,213,383	15,955,807	7.8	..	..
Detroit Edison (Year ended March 31)					
Gross earnings	56,492,085	53,672,284	5.2	66	65
Net earnings	18,909,813	18,698,270	1.1	..	..
Engineers Public Service (Year ended February 28)					
Gross earnings	51,325,066	36,091,384	42	57	58
Net earnings	21,959,067	15,165,015	45	..	..
Federal Light & Traction & subs. (Year ended February 28)					
Gross earnings	8,426,807	8,062,911	4.5	58	59
Net earnings	3,519,757	3,315,505	6.2	..	..
Nebraska Power (Year ended February 28)					
Gross earnings	6,058,015	5,433,143	12	50	51
Net earnings	3,006,361	2,643,616	14	..	..
Nevada-California Electric (Year ended March 31)					
Gross earnings	5,718,764	5,525,911	3.5	49	45
Net earnings	2,924,042	3,020,614	—3.2	..	..
North American & subs. (Year ended March 31)					
Gross earnings	148,192,225	141,515,695	4.7	52	52
Net earnings	71,877,617	67,340,093	6.7	..	..
Pacific Power & Light (Year ended February 28)					
Gross earnings	4,746,162	4,737,623	0.1	51	52
Net earnings	2,321,143	2,264,192	3.9	..	..
Public Service Corporation of New Jersey & subs. (Year ended March 31)					
Gross earnings	138,764,391	127,702,532	8.6	69*	70*
Net earnings	42,643,730	37,906,299	12.5	..	..
Southern California Edison (Year ended February 28)					
Gross earnings	40,782,782	36,098,792	13	31	29
Net earnings	27,415,997	23,712,336	16	..	..
Tennessee Electric Power & subs. (Year ended March 31)					
Gross earnings	15,113,361	13,626,113	10.9	51	51
Net earnings	7,448,423	6,644,461	12.1	..	..
United Light & Power & subs. (Year ended February 28)					
Gross earnings	96,785,224	89,905,223	7.6	57	58
Net earnings	41,805,612	37,774,761	10.7	..	..

*Operating expenses include maintenance, taxes and depreciation.

are considered as excess and divided with Houston. In 1929 Houston's share was about $110,000, in 1928 more than $115,000 and in 1927 around $101,000.

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Scottish Power Company Reveals Expansion

THE ANNUAL MEETING of the Scottish Power Company, Ltd., which has just been held in Edinburgh, reflected, through the accounts presented, the expansion of this power company's business and the consolidation of electricity supply over a large portion of Scotland. During the last ten years the combine's investments in subsidiaries has increased from £353,858 ($1,769,290) in 1920 to £3,440,173 ($17,200,865) in the year ended December 31, 1929.

It was in 1927 that the undertaking started widening and consolidating its interests, acquiring the Grampian company, and afterward other companies in the area of that company, so that it now either owns or controls ten Scottish electrical supply companies and has a substantial interest in an eleventh. The areas of supply cover about 5,000 square miles and the overhead and underground electric lines provide convenient points for connecting up outlying districts.

The generation plant in the various power stations will, with the addition of the hydro-electric plant of the Grampian company, give a total plant installed of about 80,000 kw. The total load connected as at December 31, 1929, was 63,790 kw. and the maximum load of the generating plant during 1929 was 22,207 kw. The total consumers at the end of the year were 19,264. Units sold during 1929 totaled about 70,000,000, an increase of 50 per cent in five years.

U.G.I. and United Exchange Offer Extended

THE OFFER to exchange one common share of United Corporation for one common share of United Gas Improvement Company has been extended and holders of an additional 200,000 shares of U.G.I. have expressed a desire to exchange their shares on the same basis. The transaction will result in increasing United Corporation holdings in U.G.I. to 4,851,846 common shares, or 23.6 per cent, of the 20,528,369 shares now outstanding. This may lead to United's acquiring more than 25 per cent and possibly a majority interest in the Philadelphia holding company.

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NEWS BRIEFS

Directors of the Cleveland Electric Illuminating Company have authorized the issuance of 851,490 shares of common stock. Holders of common stock of record May 6 may subscribe to one new share at $20 for each two shares held. Funds derived from the sale of stock are to be used for extensions and improvements.

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American Commonwealths Power Corporation has called for redemption on May 15 at 102½ and interest its convertible 6 per cent debentures, due 1949. These debentures are convertible into class A common on or before May 5.

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Directors of the European Electric Corporation, Ltd., have declared an initial quarterly dividend of 15 cents a share in cash on the outstanding class A and B shares, placing both classes of stock on a 60-cent annual dividend basis. The first dividend is payable May 15 to holders of record April 30, 1930.

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Philadelphia Company has added Victor Emanuel and Louis H. Seagrave of New York to the board of directors to succeed Walter T. Rose and Mason B. Starring, resigned.

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Latvia Has 37,761 Kw.

Central electric light and power plants in Latvia, one of three small countries on the shores of the Baltic that formerly constituted a portion of the old Russian Empire, exist to the number of 79 and have a total rating of 37,761 kw.

This information is contained in special circular No. 594 entitled "Central Light and Power Plants in Latvia," recently published by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C. According to the bulletin, 28 of these plants are hydro-electric, nineteen steam, thirteen gas, one is a small Diesel plant, the others have more than one kind of prime mover.

The largest in the country, at Riga, is rated at 25,000 kw. Three others exceed 1,000 kw. each; these first four comprise 31,660 kw. Sixteen, aggregating 4,475 kw., lie between 100 and 1,000 kw.; the remaining 59 together have only 1,624 kw.

Although there are a few small direct-current plants the use of three-phase, 50-cycle, 220/380-volt operation predominates. As the country has a population of 1,870,000 the rating is equivalent to 40 kw. per 1,000 people. The corresponding figure for the United States is 250 kw. per 1,000 inhabitants.

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NEW SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN APRIL

Name of Company	Amount of Issue (Par Value)	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Minnesota Power & Light Co.	$4,000,000	49	First and refunding mortgage gold bonds		4½	93½	4.85
Mississippi Power & Light Co.	4,000,000	...	Cumulative preferred stock	To provide funds to reimburse for expenditures made for property additions and acquisitions and for other corporate purposes	6	100	6
United American Utilities	112,000*	...	Class A stock	To acquire properties and additional securities, to reimburse for such expenditures and for other corporate purposes	..	...	...
American Electric Power Corp.	2,000,000	27	Convertible gold debentures, series A	To reimburse for acquisitions, additions and construction expenditures made and to be made and for other corporate purposes	6	94½	6.45
Consumers Power Co.	20,000,000	28	First lien and unifying mortgage gold bonds	To reimburse company in part for expenditures on additions and improvements to its property and for other corporate purposes	4½	97	4.70
Maryland Light & Power Co.	1,000,000	20	First mortgage gold bonds, series A	To acquire additional properties and for other corporate purposes	5½	96	5.85
Texas Power & Light Co.	4,000,000	26	First and refunding mortgage gold bonds	Construction	5	98½	5.10
Jersey Central Power & Light Co.	4,000,000	17	First mortgage and refunding gold bonds, series B	Additions to plant and equipment	5	99	5.10
Penn Central Light & Pwr. Co.	1,000,000	47	First mortgage gold bonds		4½	93½	4.85
Midland United Co.	12,125,000	...	Convertible preferred stock, series A, with warrant	To further construction program of sub-idiaries and for other corporate purposes	..	48½	....
Total			$52,125,000	Rights	$40,028,080		
Total amount actually realized			$50,950,000	Total financing for April	$90,978,080		

*Shares. Not included in total.

Business News and Markets

New York Electrical Men Mobilize to Help Industrialists

ELECTRICAL interests in greater New York jointly embarked February 24 on a co-ordinated plan to acquaint the 27,000 industrialists of that district with the economic benefits to be derived from modernization with electrical applications. Contractors, utility men and manufacturers' representatives throughout this territory have been mobilized into a single working organization, sponsored by the Electrical Association of New York. The task was undertaken at this time because the sponsors feel that industralists will be more receptive than at any other period to any ideas which will enable them to utilize their investment in plants and men more efficiently and minimize production expenses.

The plan does not differ in any way from the normal way of doing business except to bring together every one who is interested in increasing the installation and use of electrical equipment and organize them for the accomplishment of their mutual purpose with the least delay. The plan merely changes the approach from one of individual attack and solution to one of mass attack and solution. It enables industrialists to secure help quickly from the best electrical men in Greater New York.

About 150 men besides the contractors are actively participating in the organization at present, but it is flexible so men can be added to or transferred from one duty to another. Heading up all the activities is an executive committee composed of men selected for their organizing ability, knowledge of conditions and requirements, and power to marshal support. This committee is headed by Louis Kalischer, a Brooklyn contractor, with C. K. Nichols, New York Edison Company, as vice-chairman. The committee controls the policies and provides the necessary funds.

Tying this committee with the Westchester County committee and individual borough committees, of which there are five, is a management committee which serves as the clearing house for all proposals with the same officers as the executive committee.

Responsibility for operation of the plan rests in the hands of the borough committees. Each of these has a contractor for chairman, a utility vice-chairman, an adviser and members representing manufacturers of equipment for illumination, control, industrial heating, material handling, motor applications, refrigeration, signaling, signs, switchboards, tool applications, ventilation and wiring. While the management committee will have subcommittees to supervise advertising, prospect lists, speakers, finance and engineering, each of the borough committees will also have similar committees.

Contractors will be utilized as the initial contacts with industrialists, but representatives of manufacturers and utilities will collaborate with them and the prospects in solving industrial problems. Prospects secured through any source will be allocated according to district and will be displayed on the borough headquarters bulletin boards so any individual who desires to approach them may do so after recording his name.

Results have already been obtained by some of the contractors which indicate that they can solicit five times as many prospects as formerly with a better chance of securing the business.

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Short Course in Lighting Given by Westinghouse

ABOUT 6,000 STUDENTS ARE ENROLLED in a general illumination course conducted by the Westinghouse Lighting Institute, Grand Central Palace, New York. The course covers every phase of illuminating engineering and is designed to qualify employees of utilities, manufacturers and merchants in the fundamentals of good lighting practice and the modern developments of the art.

The course, it is claimed, permits an absorption of illuminating engineering that would otherwise require the study of very many volumes often beyond the convenience of most students, without detaching students from their company duties. It consists of nine assignments, each covering a specific phase of illumination, and embraces light sources, units of light measurement and photometry, principles of light control and equipment, interior lighting calculation, commercial lighting, display lighting, industrial lighting, floodlighting and street lighting.

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Manufacturing Company Reduces Prices

GENERAL ELECTRIC COMPANY has announced, effective immediately, price reductions of from 3 per cent to 5 per cent covering various standard lines of electric apparatus. These reductions were made as a reflection of the recent recession in the price of copper and apply principally to transformers, switchgear apparatus, generators, motor wheels and condensers. There is no reduction in motor prices.

W. N. Matthews Corporation has just issued a new price sheet, giving reduced prices on twelve sizes of Matthews "Scrulix" anchors.

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General Cable Reorganizes District Sales Offices

A NEW FIELD SALES POLICY has been made effective by General Cable Corporation by the establishment of eighteen district and territorial sales offices and the assignment of the entire district sales personnel of Dudlo, Rome, Safety and Standard Underground divisions to these new territories.

Until this change the sales organizations of the four divisions had functioned in parallel, maintaining the industry contacts which each had established over many years of service. Subsequent to the formation of General Cable in 1927, the industry has made increasing use of the combined manufacturing and engineering facilities of the corporation, through the channels of the individual divisions. This reorganization of sales forces further consolidates these facilities and makes them more readily available. The identities of the thirteen companies comprising the four operating divisions will be continued as manufacturing and shipping units. All present trademarks will also be continued.

Resident engineers will be located in

the district and territorial sales offices. They will represent locally the headquarters consulting engineering staff, which has been organized recently to co-ordinate for all wire and cable users the engineering knowledge and the experience in design and application of all divisions of the corporation.

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Square D-Mergers with Diamond Electrical

IT IS ANNOUNCED THAT the Square D Company of Detroit has merged with Diamond Electrical Manufacturing Company of Los Angeles. It is stated that an initial dividend of 50 cents a share quarterly, payable in cash, and 2 per cent semi-annually in stock was declared on the Square D class B stock, which previously had not been on a dividend-paying basis. Payment will be made June 30 to shareholders of record of June 20.

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Vacuum Cleaner Sales

THE ESTIMATED VOLUME of sales for vacuum cleaners for the entire industry as reported by the Vacuum Cleaner Manufacturing Association for the months of November, December, January and February were as follows:

	Units
November, 1929	111,784
December, 1929	98,268
January, 1930	73,721
February, 1930	89,414

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Appliances— $10 per Customer

SALES OF APPLIANCES made the turnover of the city of Winnipeg Hydro-Electric System in this department exceed $400 000 for the year 1929, according to the annual report recently published.

Since the number of domestic lighting customers at the end of the year was 39,031, this makes the average sales exceed $10 per lighting customer. The use of heavy appliances is exceedingly common in Winnipeg; more than half the lighting customers also have services for heating and cooking and a third of them have water heaters. Apparently the three types of service are metered separately.

The income from sales of appliances was almost a third as great as the revenue for all classes of domestic service, and two-thirds as great as the revenue for lighting alone.

The energy consumption per home is extraordinarily high; in 1929 it was 3,741 kw.-hr., all of it hydro-electric.

Lighting Systems Lead in New Construction

PUBLIC works and utilities construction contracts during the first three months of 1930 have broken all records for the past five years, according to Secretary of Commerce Lamont. Based upon F. W. Dodge Corporation figures, lighting systems accounted for $20,458,000 for the first three months, against $5,864,000 in the first quarter of 1929, which is an increase of 249 per cent. This is the largest increase of any single group.

TRADE BRIEFS

Six per cent gold debentures of the Square D Company are being offered at 99¼ and interest, yielding 6 per cent, a piece of financing involving a total of $600,000.

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Sales of the Leland Electric Company, Dayton, Ohio, for the first three months of 1930 showed a gain of 51.5 per cent, compared with the corresponding period a year ago. During the three months ended March 31 sales of the company reached $339,572, which compares with $224,083 for the same period in 1929 and $169,797 in 1928.

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Claud S. Gordon Company of Chicago has announced the purchase of all the physical assets, good will, patents, leasehold machinery, equipment and supplies of the Cleveland Instrument Company, Cleveland, Ohio, and the General Pyrometer Supply Company, also of that city. The Claud S. Gordon Company will operate the new consolidation under the name of Pyrometer Service & Supply Corporation, with headquarters in Cleveland.

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Exports of electrical machinery and apparatus from Switzerland during last year attained a value of $16,699,800, as compared with only $16,046,400 in 1928.

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National Lumber & Creosoting Company, St. Louis, Mo., has added to its staff J. A. Leiendecker to handle the sales of poles and the creosoted timber products. His headquarters will be in Dallas, Tex.

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March was the greatest month in the history of the Kelvinator Corporation, according to H. W. Burritt, vice-president in charge of sales. Shipments during March were the largest ever made by Kelvinator in any one month and 2½ times those made in February.

National Carbon Company, Inc., has announced several important personnel changes: C. E. Anderson, formerly manager of the Kansas City branch, has been appointed manager of the Eveready Prestone & Miniature Lamp Division with headquarters in the New York offices of National Carbon Company. W. H. Haile, who has been managing the Eveready Prestone & Miniature Lamp Division, becomes manager at Kansas City and D. G. Raymond, manager of the Eastern division, will become manager of the Central division with headquarters at Chicago. J. M. Spangler, present manager at Chicago, moves to New York to become manager of the Eastern division.

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The Walker Dishwasher Corporation, following its acquisition by the General Electric Company, will be changed from a New York to a Delaware corporation and will have authorized and outstanding 53,100 shares of no-par common stock, consisting of 17,700 shares of class A and 35,400 shares of class B stock.

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Twelve-Cent Copper Is Discussed

MORE RUMORS originating in Wall Street predict another copper price drop, this time to 12 cents. Operations have been at a minimum.

	April 23, 1930 Cents per Pound	April 30, 1930, Cents per Pound
Copper, electrolytic	14	14
Lead, Am. S. & R. price	5.50	5.50
Antimony	7⅛	7⅛
Nickel, ingot	35	35
Zinc, spots	5.10	5.05
Tin, straits	35⅛	33⅜
Aluminum, 99 per cent	24.30	24.30

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Entire Edison Lamp Works Organization to Convene

ON MAY 5, 6 and 7 the Edison General Sales Conference will be held by the Edison Lamp Works of General Electric Company at its new headquarters at Nela Park, Cleveland. For the first time in the company's history the entire headquarters and field organization will convene for the purpose of formulating basic sales plans and policies to guide the organization. In the three-day program, which will cover every phase of the company's operations, both from the sales and engineering standpoints, the heads of the administrative, sales administration, sales promotion and engineering departments will present the latest developments in their respective phases of the business.

Market Conditions

SEVERAL companies in the equipment field are reported to have reduced prices. There is little indication as yet that this is stimulating business materially. In some cases price bargaining is reported to be doing business much harm. Equipment orders to industrials are on a substantial basis in New England, but not above normal.

——BUSINESS THROUGHOUT THE EASTERN DISTRICT is spotty this week, but central station commitments are well sustained.

——PACIFIC COAST BUSINESS IS ABOUT NORMAL but slightly below earlier expectations.

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EASTERN

—BUSINESS IS INCLINED *to be a little spotty in the electrical equipment market in the Eastern district. The larger manufacturers report trade as fairly satisfactory, with immediate future prospects quite bright, while other producers say that demand is falling off.*

—CENTRAL-STATION COMMITMENTS *continue to trend to transmission and distributing equipment; railroad account is active for insulating materials and industrial business is brightest for motors and accessory apparatus. The demand for airport lighting equipment is improving.*

A Long Island power company has placed a contract with a New York manufacturer for substation apparatus to an amount of $40,000. A central station on the Pacific Coast has ordered switchgear and condensers from a New York maker costing $50,000. A metropolitan utility company has ordered a quantity of switchgear to cost $40,000, while a New Jersey central station has placed a contract for transformers and accessories totaling $35,000. The General Electric Company will furnish twelve reels of power cable, 4½ in. in diameter, each reel weighing 35 tons, to the Consolidated Gas, Electric Light & Power Company, Baltimore, for 35,000-volt service. The Brooklyn Edison Company has entered the market for two turbo-generator units, each of 160,000-kw. rating, for installation at its Hudson Avenue power station and, it is understood, will place contract at an early date; with boilers and auxiliary equipment, the expansion is estimated to cost over $12,000,000.

While railroad purchases for electrification programs have eased a little, there are still some sizable transactions going forward in that line, with inquiries indicating early future orders.

The outlook for street-lighting equipment and affiliated installations, including airport lighting apparatus, is encouraging. A number of sizable orders are in sight and inquiries show higher volume. The Crouse-Hinds Company, Syracuse, N. Y., is furnishing equipment for a traffic signal system in a Texas municipality. A manufacturer of electric washing machines in northern New York has purchased a quantity of fractional-horsepower motors from a state maker, costing $55,000.

CONSTRUCTION PROJECTS

Buffalo General Electric Company, will build power substation on Perry Street. DuPont Cellophane Company, Buffalo, N. Y., plans transparent paper mill at Ampthill, Va., to cost $5,000,000. General Baking Corporation, New York, plans plant at Detroit, Mich., to cost $1,000,000. General Electric Company, Schenectady, N. Y., plans factory branches and distributing plants at Cleveland, Ohio, and Minneapolis, Minn., to cost $800,000 and $500,000, respectively. Board of Education, Newark, N. J., will receive bids until May 7 for electrical supplies, manual training equipment, etc. Public Service Electric & Gas Company, Newark, N. J., has filed plans for power substation to cost $90,000. Board of Education, Philadelphia, Pa., will receive bids until May 6 for electrical materials. Department of Property and Supplies, Harrisburg, Pa., will receive bids until May 20 for incandescent lamps. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until May 6 for electric supplies and fixtures (Panama Schedule 2552).

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SOUTHEAST

—PRICE REDUCTIONS ANNOUNCED *recently served somewhat to dry up orders but brought out a considerable amount of inquiries, particularly in copper. However, the volume of small orders continues reasonably satisfactory.*

The largest order reported in the territory last week was from a South Carolina textile plant for $25,000 in motors and control equipment and the wiring contract was let on a tobacco plant in Virginia involving $20,000 in wiring supplies. A Georgia central station ordered two 3,000-kva. transformers and poles and line hardware aggregating $11,000. Some other central station orders were for $9,300 in aluminum cable, $6,900 in oil circuit breakers and $5,300 in house type meters. An Alabama company is in the market for 120,000 lb. of bare and weatherproof copper, while a North Carolina company has asked bids on 45,000 lb. of bare. Two of the small privately owned systems in Georgia placed orders last week for distribution materials amounting to $4,000 and $1,900. A railroad in this section is expected to order this coming week more than 100,000 lb. of bare copper for use in its signal system.

CONSTRUCTION PROJECTS

Appalachian Electric Power Company, Bluefield, W. Va., plans installation of lighting system at Welch, W. Va. Louisville Gas & Electric Company, Louisville, Ky., plans transmission line from Waterside power station to cost $100,000. Covington, Tenn., has approved plans for addition to municipal power plant. Southern Power Company, Charlotte, N. C., plans extensions in power plant at Pickens, S. C., and installation of ornamental lighting system at Aiken, S. C. Ocala, Fla., plans extensions and improvements in municipal power plant.

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NEW ENGLAND

—PROMINENT MANUFACTURERS *in this district report a favorable trend in orders for electrical equipment.*

—INDUSTRIAL EQUIPMENT ORDERS *are being received in a steady volume and prominent manufacturers report little slackening in the demand for small motors, general scheduled materials and specialties, including power switch and control apparatus.*

Recently a 3,000-kw. turbo-generator was placed for a prominent New England textile mill. Orders for similar equipment are pending for New England mills. Small motor sales are holding up well. Orders for switch and control apparatus are steady. Central station supplies are somewhat spotty. One distributor reports steady demand for insulators in small lots. Another reports a good movement in outside switch and control equipment. Line supplies are being rushed and orders placed for poles, cross-arms and insulators for line extensions in northern New England districts. Street lighting is active. One town in southern Massachusetts plans new installations to cost about $2,500.

Interest in electric arc welders continues strong. Negotiations have fallen off for electric heating furnaces, though

one manufacturer reports a number of interesting orders which are expected to be placed soon. Contrary to general opinion, merchandising of electrical appliances as reported by a large group of central stations shows no let-down in sales volume as compared with last year and an encouraging gain is reported.

CONSTRUCTION PROJECTS

State School Board, Hartford, Conn., plans extensions to power plant at State School at Mansfield, to cost about $70,000. Crawford Oven Company, New Haven, Conn., plans plant to cost $100,000. Edison Illuminating Company of Boston plans new substation at Concord, Mass.

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MIDDLE WEST

—A SLIGHT ACCELERATION *in general business was noticeable this week in the Middle West section. Reports of the large mail order houses indicate a 20 per cent gain in sales, the steel industry is in better shape and the automotive industry shows signs of improvement. Industrial activity is spotty, while some relief seems in view for the building industry.*

The various utility companies are continuing with their conservative policy for all necessary construction and expansion work. Some of the interesting orders placed this week include one 150,000-kw. turbo-generator set, complete with generator, air coolers, blowers and spare parts, to cost approximately $1,750,000, combustion control equipment to cost $16,000 and several construction orders aggregating $150,000.

Jobbers' sales are somewhat better, although the volume of business is off considerably. Railroad business still continues to be one of the main sources of the jobber's revenue.

CONSTRUCTION PROJECTS

Allis-Chalmers Manufacturing Company, West Allis, Wis., has asked bids for addition to electrical equipment plant to cost $250,000. LaCrosse, Wis., will receive bids until May 7 for an ornamental lighting system. Superior, Wis., plans arc lamp lighting system. Republic Aircraft Corporation, Chicago, Ill., has plans for aircraft factory at Kankakee, Ill., to cost $1,000,000. Winnetka, Ill., plans addition to municipal power plant to cost $300,000. Lake Forest, Ill., plans ornamental lighting system to cost $100,000. South Haven, Mich., has approved plans for addition to municipal power plant to cost $100,000. General Kontrolar Company, Dayton, Ohio, plans addition to electric equipment plant to cost $100,000. Central States Power & Light Corporation, Dubuque, Iowa, plans generating plant at Harvey, N. D., to cost over $200,000. Northern States Power Company, Minneapolis, Minn., plans addition to power plant at Minot, N. D., to cost $150,000. Otter Tail Power Company, Fergus Falls, Minn., has approved plans for power plant at Appleton, Minn.

PACIFIC COAST

—DESPITE FAVORABLE *natural conditions, especially in northern California, business is only fair. Buying is very cautious. Many promising projects are awaiting a general movement, which their own overcaution tends to postpone. Contractors are thereby hurt and dealers are affected by a marked tendency of the individual to retrench. However, there is much constructive endeavor, such as chamber of commerce campaigns in Stockton and Sacramento and a window-lighting campaign in the Watsonville, Gilroy, Salinas and Santa Cruz quadrilateral, whereby dealers may turn their customers over to the power company on a partial-payment plan.*

Theater building is very brisk, the Publix group announcing a $1,000,000 theater for Oakland and Fox announcing three of 1,500 capacity in Los Angeles and three others, costing about $300,000 each, for San Joaquin Valley cities. Machinery sales include $30,000 worth of Westinghouse switching equipment and a $10,000 General Electric switchboard for the Pacific Gas & Electric Company.

Other power company sales cover two carloads of bare copper wire, principally size 4; three carloads of 35 and 45-ft. poles, a quarter carload of No. 2 bare copper wire for Hawaiian plantations, one carload of porcelain insulators and several smaller isolated plant jobs for Reno, Alturas and Arizona districts. Much state business is being placed as the third quarter of the fiscal year closes, and this is also the season for many municipal bids for lamp requirements. Street-lighting prospects include a San Francisco installation for Hyde Street district, 137 standards for Fresno, 72 for Bakersfield and 46 for Pacific Grove.

Fairly active movement in crossarms and pole line hardware is reported, the major portion of buying by Puget Sound Power & Light Company for extensions and replacements. This company is placing an order for 1,000,000 lb. of copper wire, about 50 per cent weatherproof, the remainder bare. Sales of three 1,000-kva. transformers, approximately $3,500 in miscellaneous switchgear and $50,000 worth of cable, the latter to Puget Sound Navy Yard at Bremerton, for cruiser construction. Other sales reported include one 10,000-kva. synchronous condenser to Pacific Power & Light Company for its Yakima plant, three synchronous motors from 175 hp. to 60 hp. to a cold storage plant in Tacoma, two 100-hp. motors to a sawmill, four machines, including two 50s to a pulp mill, five machines of 100 hp. down to a pumping plant and 42 motors to scattered mills, industrials and dealers. Another jobber reported ten machines from 40 hp. down to a paper mill and another two 150-hp. motors to a lumber mill at Longview. The Board of Contracts and Awards, Tacoma, is taking bids until May 12 for three single-phase, 60-cycle, 1,000-kva. power transformers. The contract for the refrigerating equipment in the port of Tacoma's cold storage plant has been let to Carbondale Machinery Company, Carbondale, Pa., for $52,400.

CONSTRUCTION PROJECTS

Stockton, Calif., contemplates a municipal hydro-electric generating plant to cost $1,500,000. San Francisco, Brawley, Los Angeles, Porterville, Culver City and San Mateo, Calif., plan ornamental lighting systems. Ford Motor Company, Detroit, Mich., contemplates assembling plant at Seattle, Wash., to cost over $1,000,000. Bozeman, Mont., plans ornamental lighting system. Utah Power & Light Company, Salt Lake City, Utah, plans extensions in transmission lines at Poplar, Idaho, and vicinity. Salt Lake City and Price, Utah, plan ornamental lighting systems. Colorado Springs, Colo., has plans for an addition to municipal electric light and power plant.

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SOUTHWEST

—PREVIOUS REPORTS *as to favorable prospects for electrical business have been confirmed in the past week.*

—CENTRAL STATIONS *are still buying in good volume. Several orders for distribution transformers indicate increasing demand for power and that the quiet period in March was only temporary.*

Contracts reported closed during the past week include a 10,000-kva. turbo-generator unit costing $185,000, eighteen synchronous motors, 800 hp. each, with control equipment for operating six pipe line pumping stations to cost $100,000, an order for transformers and switchboard equipment for a large power company costing $50,000, a lot of distribution transformers totaling $10,000, the material to be used in revamping; street railway equipment to speed up service costing $12,000 and a dynamometer for testing piston rings $6,000.

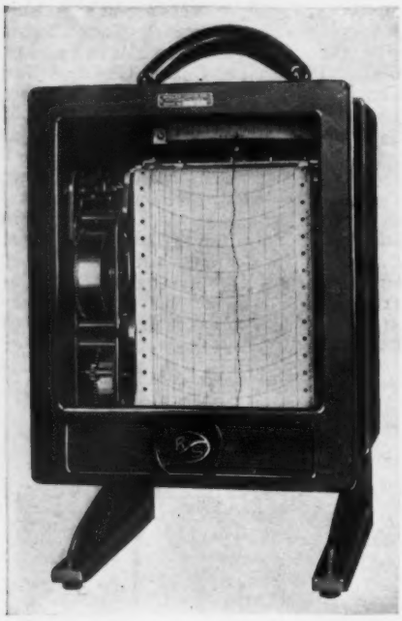
CONSTRUCTION PROJECTS

Kansas City Power & Light Company, Kansas City, Mo., plans power substation to cost $50,000. United Light & Power Corporation, Abilene, Kan., plans power plant at Manhattan, Kan., to cost over $200,000. Board of Administration, Topeka, Kan., plans local vocational school to cost $100,000. Dallas Power & Light Company, Dallas, Tex., contemplates steam-operated electric power plant to cost $5,000,000. Central Power & Light Company, San Antonio, Tex., plans hydro-electric power plant on Rio Grande River, to cost over $1,000,000.

New Equipment Available

Graphic Instruments Have Magnetic Damping

AN IMPORTANT ADDITION to its lines, namely, types AG and DG graphic instruments, has been announced by the Roller-Smith Company, 233 Broadway,



New York, N. Y. These instruments are made in the switchboard, wall and portable models, for direct and alternating current and as ammeters, voltmeters, single and polyphase wattmeters and power-factor meters. The listings cover ranges required for most graphic instrument measurements. A few of the special features claimed for this line of instruments are an exceptionally rugged and dependable eight-day clock, a positive chart drive, accessibility of all parts, light but rigid cases, an easy means of inserting ink in the well and removing the pen, and magnetic damping on all types.

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AN IMPROVED TYPE OF SINGLE-CIRCUIT TOWER is announced by the Blaw-Knox Company, Pittsburgh, Pa. The lower portion is square and all four faces are alike. This is not only an efficient method of distributing the broken wire load to the foundations, but, it is pointed out, it allows the use of variable legs and body extensions, which is the economical method of increasing the height of a tower or taking care of the difference in elevation of the ground line at the corners of a tower. The variable legs, together with the horizontal struts and horizontal cross bracings, are assembled in place as a template for setting the anchors. These parts are shipped with the anchors and once assembled are left in place. The carrying about of a special template is unnecessary.

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AN ELECTRIC TACHOMETER designed to indicate the speed of aircraft engines has been announced by the General Electric Company. This tachometer operates on the principle of generated frequency (instead of generated voltage) of a small magneto type generator which is part of the equipment. The generating unit weighs 1 lb. 7 oz., the indicating instrument 10½ oz., the transformer 11 oz. and, with the addition of the usual length of armored twin-conductor wiring, the total weight is 3 lb.

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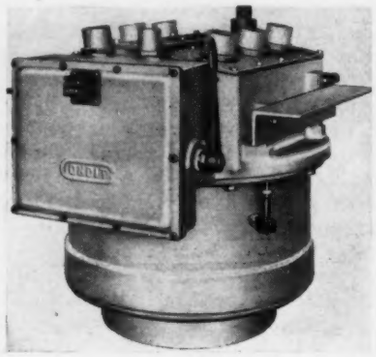
Manhole Circuit Breaker for 7,500-Volt Service

A NEW MANHOLE OIL CIRCUIT BREAKER of moderate interrupting capacity for underground distribution service up to 7,500 volts has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston, Mass. The new breaker, known as type M-10, is of sturdy, water-tight construction throughout. A massive frame structure, heavily reinforced, supports the operating mechanism, bushings and current-carrying parts. In the upper part of



the frame space is provided for two bushing current transformers per pole, in connection with which up to four trip coils can be furnished.

The type M-10 is furnished manually operated, three-pole, single-throw, for 400, 600 and 800 amp. at 7,500 volts, non-automatic or full automatic (trip free), with an estimated interrupting capacity of 35,000 kva.

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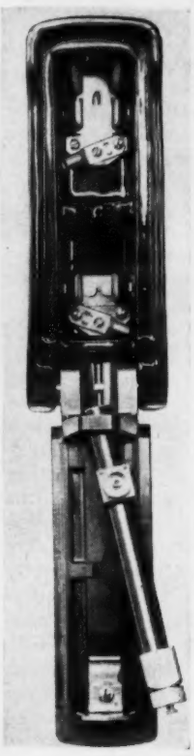
Primary Fuse Cutouts for Crossarm Mounting

A COMPLETE NEW LINE of primary fuse cutouts, identified as the type ES, which provide reliable protection from overloads and short circuits for distribution transformers and in which several new features are incorporated, has been announced by the Westinghouse Electric & Manufacturing Company. The fuse cutouts are especially designed for crossarm mounting and are made in four sizes. The cutout cover is hinged at the bottom, and when it is opened the fuse is removed from all live contacts and to a distance which permits safe handling. The fuse tube can be removed from the cover safely. The housing is made of wet process porcelain of high dielectric strength. The cover is "Moldarta," a molded insulating compound impervious to moisture.



All metal parts are plated to prevent corrosion. Insulation barriers at the bottom and in the housing prevent gases entering and causing arcing between contacts.

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A CONTINUOUS ELECTRIC FURNACE for making vitreous enameled resistors has been announced by the Gas Equipment Engineering Corporation, Philadelphia, Pa. The heating cycle includes preheating, burning and slow cooling the resistors in separate automatically controlled zones. Variable speed drive and full automatic temperature control and recording instruments are included as standard equipment.

Table I—Data on Output an Systems

These data include all public utility, lighting, power and elec

Line No.	Company or System*	1929								
		Rank in 1929	System Peak Load Kw. (Instantaneous)	System Peak Load (Est. Over Thirty-Minute Period) Kw.	Date of Instantaneous System Peak	Output for Year Kw.-Hr. (Including Purchased Energy)	Average Load in Kw.	System Peak Load Kw. (Instantaneous)	Syst Peak (Est. Thi Min Peri Kw
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(1
	United States								
1	Niagara Hudson Power Corporation System* (*C*)	1	1,148,600	.....	Nov. 13	7,212,743,072	823,400	.....	.....
2	The New York Edison and Allied Companies* (*H*)	2	1,225,000	1,209,000	Dec. 17	4,678,700,000	534,000	1,146,000	1,12
3	Commonwealth Edison Company	3	1,028,500	1,000,200	Dec. 2	4,636,434,000	529,000	1,050,000	1,01
4	Southern California Edison Company	4	571,000	.....	Oct. 22	3,162,988,030	361,000	516,100	.....
5	Philadelphia Electric Company System* (*F*)	5	(*G*) 740,000	(*G*) 713,000	Dec. 2	3,029,885,631	346,000	581,000	56
6	Pacific Gas & Electric Company	6	513,800	.....	Dec. 6	2,717,874,472	310,000	484,600	.....
7	The Detroit Edison Company	7	.....	547,600	(*n*) April 11	2,654,901,300	303,000	509,300	(*a*) 50
8	Public Service Electric & Gas Company (N. J.)	8	536,600	517,225	Dec. 16	2,134,581,298	243,600	480,500	47
9	Duke Power Company	9	432,000	432,000	Dec. 17	1,981,239,709	226,000	422,600	42
10	The West Penn Electric Company Subsidiaries	10	.....	(*o*) 362,787	.....	1,938,955,818	221,000	.....	(*o*) 31
11	The North American Co. System (Mo., Ill. & Iowa Group)	11	350,000	.....	Oct. 28	1,871,797,392	213,500	355,611	.....
12	Alabama Power Company*	12	.....	376,400	Sept. 6	1,715,250,122	195,600	.....	(*a*) 33
13	New England Power Association System*	13	406,300	395,000	Dec. 4	1,703,536,819	194,400	.....	(*b*) 31
14	The North American Company System (California Group)	14	325,430	.....	Aug. 6	1,692,113,398	193,000	290,390	.....
15	The Montana Power Company	15	.....	(*o*) 229,800	(*o*) April	1,611,521,000	184,000	.....	.....
16	Duquesne Light Company	16	.....	.....	.....	1,573,445,327	179,200	295,300	.....
17	The Ohio Power Company	17	276,000	.....	Oct. 17	1,544,252,000	176,000	224,000	.....
18	Appalachian Electric Power Company	18	265,000	.....	Dec. 17	1,484,761,000	169,300	230,000	.....
19	The Cleveland Electric Illuminating Company	19	315,870	.....	Dec. 18	1,447,193,594	165,000	331,768	.....
20	The North American Co. System (Wisconsin-Michigan Group)	20	284,359	.....	Nov. 13	1,311,738,004	149,000	262,860	.....
21	Pennsylvania Power & Light Company	21	.....	(*o*) 285,800	(*o*) Dec.	1,251,104,868	142,800	(*A*) 253,000	.....
22	Public Service Company of Northern Illinois	22	.....	190,123	Oct. 22	1,246,330,283	142,100	.....	17
23	Columbia Gas & Electric Corporation System	23	263,000	261,000	Nov. 13	1,203,652,405	137,400	252,000	24
24	Consumers Power Company	24	271,052	270,772	May 14	1,198,947,711	137,000	232,980	23
25	Georgia Power Company*	25	.....	257,125	.....	1,146,516,743	130,900	.....	22
26	The Edison Electric Illuminating Company of Boston	26	275,501	.....	Oct. 7	1,041,388,668	118,900	252,777	.....
27	Northern States Power Company (Del.) Subsidiaries	27	.....	.....	.....	969,071,015	110,700	.....	.....
28	Puget Sound Power & Light Company	28	193,392	.....	Dec. 13	941,992,205	107,500	169,219	.....
29	Consolidated Gas Electric Light & Power Co. of Baltimore	29	.....	(*b*) 186,000	(*o*) Dec. 11	910,934,486	104,000	.....	(*b*) 16
30	Utah Power & Light Company	30	.....	(*o*) 142,505	(*o*) Nov.	882,360,000	100,700	(*A*) 132,390	.....
31	The Washington Water Power Company	31	.....	(*o*) 172,735	(*o*) March	858,353,000	97,900	.....	.....
32	The Tennessee Electric Power Company	32	165,000	157,600	Aug. 21	819,723,857	93,500	152,200	14
33	Pennsylvania-New Jersey Power System (*P*)	33	(*i*) 165,000	(*c*) 158,320	July 9	735,612,022	83,900	(*i*) 150,000	(*b*) 14
34	City of Los Angeles, Bureau of Power & Light	34	162,000	161,000	Dec. 6	722,998,796	82,500	153,200	15
35	Oklahoma Gas & Electric Company	35	.....	.....	.....	692,070,936	79,000	.....	.....
36	Texas Electric Service Company*	36	.....	.....	.....	665,625,000	76,000	(*A*) 67,494	.....
37	Kansas City Power & Light Company	37	139,400	132,400	Dec. 17	645,165,032	73,600	127,300	12
38	The Pennsylvania-Ohio Power & Light Company	38	.....	124,800	(*n*) May 21	634,346,780	72,500	.....	(*o*) 13
39	The Ohio Public Service Company	39	.....	(*b*) 114,900	(*o*) Aug. 20	611,482,217	69,800	.....	(*b*) 11
40	Pennsylvania Water & Power Company	40	(*i*) 134,000	(*o*) 129,600	Nov. 19	610,962,200	69,750	(*i*) 129,000	(*c*) 12
41	Portland Electric Power Company	41	.....	(*o*) 123,600	(*o*) Jan. 4	603,423,300	68,800	.....	(*b*) 12
42	The Connecticut Light & Power Company	42	.....	(*o*) 123,915	Dec. 17	580,426,439	66,250	.....	.....
43	Illinois Power & Light Corporation (Illinois)*	43	.....	108,300	.....	542,629,220	61,900	.....	10
44	Indiana & Michigan Electric Company	44	106,190	.....	Jan. 22	538,734,000	61,400	91,560	.....
45	The Toledo Edison Company	45	.....	(*b*) 123,700	(*o*) Sept.	514,989,108	58,700	.....	10
46	Louisiana Power & Light Company	46	.....	(*o*) 110,464	(*o*) Oct.	511,225,000	58,300	(*A*) 92,553	.....
47	Houston Lighting & Power Company	47	.....	(*o*) 96,205	(*o*) Oct.	510,247,000	58,200	(*A*) 82,600	.....
48	Western Massachusetts Companies System*	48	.....	(*c*) 105,100	Dec. 17	494,805,982	56,400	.....	.....
49	Virginia Electric & Power Company	49	(*i*) 105,000	(*a*) 101,800	Dec. 11	480,970,175	54,800	.....	9
50	Carolina Power & Light Company	50	.....	(*o*) 108,000	(*o*) Nov.	476,878,300	54,400	(*A*) 107,000	.....
51	Idaho Power Company	51	.....	(*o*) 71,114	(*o*) Nov.	471,732,000	53,800	(*A*) 72,080	.....
52	Hetch Hetchy Water Supply City & County of San Francisco	52	83,400	83,400	June 3	464,339,110	53,000	82,400	8
53	Potomac Electric Power Company	53	120,000	118,000	Dec. 11	449,794,685	51,300	110,500	10
54	Texas Power & Light Company	54	.....	(*o*) 102,780	(*o*) Sept.	442,818,000	50,500	(*A*) 92,620	.....
55	State Line Generating Company	55	165,400	163,900	Oct. 17	(*I*) 430,779,000	(*I*) 97,500	.....	.....
56	Minnesota Power & Light Company	56	.....	(*o*) 87,736	(*o*) May	427,848,189	48,800	(*A*) 80,696	.....
57	Central Indiana Power Company Subsidiaries	57	.....	(*b*) 93,170	.....	424,300,963	48,400	.....	(*c*) 8
58	The California Oregon Power Company	58	94,575	.....	Dec. 12	410,083,711	46,800	.....	.....
59	Rochester Gas & Electric Corporation	59	91,523	(*c*) 83,023	Dec. 17	393,506,327	44,900	84,900	(*o*) 7
60	Indianapolis Power & Light Company	60	.....	82,800	.....	388,871,320	44,400	76,600	7

Supplement to ELECTRICAL WORLD, May 3, 1930

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nd Peak Load of Largest Generating and D
ns in North America, 1924—1929

lectric railway systems in the United States, Canada and Mexico having yearly output in excess of 100,000,000 kw.-hr. du

1928				1927				1926			
System Peak Load (Est. Over Thirty-Minute Period) Kw. (10)	Date of Instantaneous System Peak (11)	Output for Year Kw.-Hr. (Including Purchased Energy) (12)	Average Load in Kw. (13)	System Peak Load Kw. (Instantaneous) (14)	System Peak Load (Est. Over Thirty-Minute Period) Kw. (15)	Date of Instantaneous System Peak (16)	Output for Year Kw.-Hr. (Including Purchased Energy) (17)	Peak Load Kw. (Instantaneous) (18)	Date of Instantaneous Peak (19)	Output for Year Kw.-Hr. (20)	Peak Kw (Inst taneo (21
1,125,000	Dec. 20	4,210,700,000	479,000	784,077	765,703	Dec. 13	2,877,090,621	731,964	Dec. 20	2,554,025,704	65
1,016,000	(n) Dec. 21	4,174,661,000	475,000	952,000	916,000	Dec. 8	3,778,380,000	897,000	Dec. 15	3,482,632,000	80
	Oct. 26	2,762,459,843	314,500	448,900		Dec. 9	2,421,357,098	422,700	Nov. 9	2,227,879,772	39
561,400	Dec. 17	2,266,856,345	258,000	455,000	447,300	Dec. 19	1,860,613,091	444,000	Dec. 20	1,749,016,316	38
	Dec. 14	2,545,713,564	289,800	439,568		July 29	2,322,015,035	406,970	Dec. 22	2,157,886,980	38
507,700	Nov. 19	2,438,304,900	277,600	447,500	(a) 443,800	Dec. 20	2,142,549,100	439,000	Sept. 15	2,025,063,700	39
471,000	Dec. 17	1,879,024,063	213,900	435,500	422,000	Nov. 28	1,701,886,359	415,000	Dec. 13	1,560,801,782	36
422,600	Oct. 9	1,847,072,621	210,300		398,300		1,745,776,428	(c) 337,040	(o) Dec. 13	1,433,759,975	(c) 29
319,325		1,764,742,160	201,000		(b) 332,405		1,727,565,353	(b) 313,040	(o) Dec. 8	1,514,609,984	
	Dec. 17	1,719,825,708	195,800	319,599		Dec. 6	1,449,881,883	278,121	Dec. 8	1,337,733,243	25
338,600	(n) Feb. 13	1,586,177,553	180,500		248,280	(n) Oct. 24	1,759,143,119				
315,000	(o) Dec. 11	1,384,834,239	157,700		(o) 243,650	(o) Dec. 19	1,104,515,942	(c) 179,200	(o) Oct. 20	716,087,950	(c) 16
	July 25	1,537,851,047	175,100	271,665		July 20	1,351,590,977	251,660	July	1,334,964,749	
		1,583,985,000	180,300	191,100	187,900	March 1	1,366,997,834	188,400	Oct. 15	1,379,194,095	17
	Dec. 11	1,434,185,024	163,300	276,900	274,000	Jan. 24	1,328,526,578	284,260	Dec. 15	1,332,033,978	27
	Dec. 11	1,305,004,000	148,500	211,000		March 10	1,131,133,000	202,000	Oct. 20	1,109,315,094	(n) 18
	Dec. 18	1,270,328,000	144,600	216,000		April 16	1,095,378,000	205,000	Oct. 20	975,664,102	
	Oct. 23	1,282,476,855	146,000	293,731	285,000	Dec. 13	1,138,838,831	287,119	Dec. 15	1,118,294,193	25
	Nov. 19	1,148,886,380	130,800	229,314		Oct. 5	1,026,886,645	210,420	Dec. 15	959,430,412	20
	(A) Dec.	1,176,653,000	133,900	(A) 203,002		(A) Dec.	908,579,200	194,402	Nov.	858,001,300	13
178,016	Dec. 13	1,047,466,830	119,200		(G) 154,044		884,762,116	(n,G) 139,809	(n) Dec. 13	720,018,554	(d) 16
249,000	Dec. 4	1,052,549,327	119,800	213,000		Nov. 9	936,704,222				
230,000	Dec. 17	1,102,278,322	125,500	225,919	225,804	Sept. 20	930,285,847	118,113	Nov. 9	809,134,896	15
223,700		909,962,847	103,500		185,000	(n) Oct.	697,306,888				
	Nov. 2	857,209,496	97,600	224,508		Dec. 19	748,502,053	190,276	Dec. 17	673,760,354	20
		908,760,906	103,500				839,375,628	181,677	Dec. 6	805,380,692	16
	Dec. 20	877,953,546	100,000	158,453	155,453	Dec. 21	787,258,688	135,665	Dec. 20	708,450,887	13
167,900	(o) Dec. 20	825,430,643	94,000		(c) 165,000	Nov. 21	786,877,691	(c) 162,500	(o) Dec. 21	802,768,634	(b) 16
	(A) Dec.	830,862,000	94,600	(A) 118,678		(A) Sept.	784,402,000	120,270	Dec.	801,444,000	11
		746,709,000	85,000	128,120	113,570	Dec. 28	633,019,740	103,783	Dec. 22	571,833,994	10
145,300	March 9	730,061,103	83,100	137,800	129,000	Jan. 27	651,397,468	136,800	Jan. 12	653,812,207	15
143,500	Dec. 5	645,621,149	73,500	(i) 140,000	(b) 132,350	June 28	782,173,960	150,000	Oct. 20	937,689,159	
152,000	Dec. 10	639,415,709	72,800	133,300	132,400	Dec. 21	584,279,702	121,700	Dec. 3	521,136,258	10
		567,869,411	64,600				399,543,412	54,942	Nov. 29	207,140,920	4
	(A) Oct.	381,404,000	43,400				241,723,000				
120,300	Dec. 21	584,714,544	66,600		(h) 120,806	(m) Dec. 15	488,156,281	(h) 73,200	(m) Oct. 19	365,170,871	(m) 7
132,233	Oct. 23	606,647,383	69,100		(b) 113,234	Feb. 15	574,290,447	(c) 120,667	Dec. 22	543,152,601	(i) 10
111,800	(o) Dec. 18	559,090,541	63,700		(c) 98,700	(o) July 27	495,593,161	(b) 107,400	(o) Jan. 15	535,078,389	10
124,500	Dec. 5	655,035,700	74,600	(i) 127,000	(c) 120,200	Dec. 9	634,248,100	(i) 120,000	June 22	631,681,400	11
128,500	(o) Jan. 6	549,922,100	62,600		(b) 120,900	Dec. 30	495,663,700	(h) 121,300	Dec. 17	476,272,500	(c) 10
		445,804,848	50,800				354,047,654	(b) 69,870	(o) Dec. 15	286,218,156	(b) 6
105,000	(n) Dec. 12	491,171,956	55,800								
	Oct. 29	454,600,000	51,800	90,110		Dec. 13	390,808,000	91,490	Nov. 16	318,395,010	(b) 5
100,020	(n) Dec. 14	458,973,651	52,300		(c) 81,400	(o) Dec. 19	382,228,176	77,400	May 26	350,695,351	(k) 8
	(A) Oct.	390,533,000	44,400				250,542,000	34,000	Dec.	122,937,000	
	(A) Oct.	436,633,000	49,700	(A) 75,000		(A) Oct.	362,094,000	56,000	Dec.	263,299,360	3
95,100	(n) Dec. 7	440,886,606	50,200		(a) 88,200	Dec. 9	409,680,096	(n) 82,300	(n) Dec. 9	377,662,174	(n) 7
	(A) Oct.	430,427,600	49,000	(A) 101,000		(A) Dec.	426,426,000	(L) 95,000		(L) 426,399,670	4
	(A) Nov.	506,009,000	57,600	(A) 70,245		(A) Dec.	352,253,000	47,990	Aug.	266,320,000	3
82,400	June 9	528,895,495	60,200								
108,000	Nov. 26	413,992,663	47,100	101,000	98,500	Dec. 19	383,128,587	91,500	Dec. 15	350,024,224	8
	(A) Sept.	374,563,000	42,700	(A) 84,200		(A) Sept. 14	355,707,000	76,300	Dec.	339,468,000	5
	(A) Aug.	416,134,000	47,400	(A) 77,950		(A) Nov.	401,856,000	86,410	Oct.	399,825,337	7
84,205	(o) Dec.	383,337,429	43,600	74,100	74,000	Sept. 7	305,326,889	80,070	Dec. 18	334,518,201	7
		441,845,615	50,300				374,724,290	67,040	Dec. 6	293,010,721	6
75,290	Nov. 19	376,764,523	42,900	80,150	71,670	Nov. 28	352,809,582	77,680	Dec. 1	326,148,706	7
76,600	Dec. 4	356,228,046	40,600		63,500		328,712,384				

Supplement to ELECTRICAL WORLD, May 3, 1930

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ata on Output and Peak Load of Largest
Systems in North America, 1924

a include all public utility, lighting, power and electric railway systems in the United States, Canada and Mexico having ye

1929				1928					1927			
em Load Over ty- ute od)	Date of Instantaneous System Peak (6)	Output for Year Kw.-Hr. (Including Purchased Energy) (7)	Average Load in Kw. (8)	System Peak Load Kw. (Instantaneous) (9)	System Peak Load (Est. Over Thirty-Minute Period) Kw. (10)	Date of Instantaneous System Peak (11)	Output for Year Kw.-Hr. (Including Purchased Energy) (12)	Average Load in Kw. (13)	System Peak Load Kw. (Instantaneous) (14)	System Peak Load (Est. Over Thirty-Minute Period) Kw. (15)	Date of Instantaneous System Peak (16)	Outpu K (In Pur En
.....	Nov. 13	7,212,743,072	823,400	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,000	Dec. 17	4,678,700,000	534,000	1,146,000	1,125,000	Dec. 20	4,210,700,000	479,000	784,077	765,703	Dec. 13	2,8
0,200	Dec. 2	4,636,434,000	529,000	1,050,000	1,016,000	(n) Dec. 21	4,174,661,000	475,000	952,000	916,000	Dec. 8	3,7
.....	Oct. 22	3,162,988,030	361,000	516,100	.....	Oct. 26	2,762,459,843	314,500	448,900	.....	Dec. 9	2,4
3,000	Dec. 2	3,029,885,631	346,000	581,000	561,400	Dec. 17	2,266,856,345	258,000	455,000	447,300	Dec. 19	1,8
.....	Dec. 6	2,717,874,472	310,000	484,600	.....	Dec. 14	2,545,713,564	289,800	439,568	.....	July 29	2,3
7,600	(n) April 11	2,654,901,300	303,000	509,300	(a) 507,700	Nov. 19	2,438,304,900	277,600	447,500	(a) 443,800	Dec. 20	2,1
7,225	Dec. 16	2,134,581,298	243,600	480,500	471,000	Dec. 17	1,879,024,063	213,900	435,500	422,000	Nov. 28	1,7
2,000	Dec. 17	1,981,239,709	226,000	422,600	422,600	Oct. 9	1,847,072,621	210,300	.....	398,300	.....	1,7
2,787	.....	1,938,955,818	221,000	.....	(o) 319,325	.....	1,764,742,160	201,000	.....	(b) 332,405	.....	1,7
.....	Oct. 28	1,871,797,392	213,500	355,611	.....	Dec. 17	1,719,825,708	195,800	319,599	.....	Dec. 6	1,4
6,400	Sept. 6	1,715,250,122	195,600	.....	(a) 338,600	(n) Feb. 13	1,586,177,553	180,500	.....	248,280	(n) Oct. 24	1,7
5,000	Dec. 4	1,703,536,819	194,400	.....	(b) 315,000	(o) Dec. 11	1,384,834,239	157,700	.....	(o) 243,650	(o) Dec. 19	1,1
.....	Aug. 6	1,692,113,398	193,000	290,390	.....	July 25	1,537,851,047	175,100	271,665	.....	July 20	1,3
9,800	(o) April	1,611,521,000	184,000	.....	.....	.....	1,583,985,000	180,300	191,100	187,900	March 1	1,3
.....	.....	1,573,445,327	179,200	295,300	.....	Dec. 11	1,434,185,024	163,300	276,900	274,000	Jan. 24	1,3
.....	Oct. 17	1,544,252,000	176,000	224,000	.....	Dec. 11	] 1,305,004,000	148,500	211,000	.....	March 10	1,1
.....	Dec. 17	1,484,761,000	169,300	230,000	.....	Dec. 18	1,270,328,000	144,600	216,000	.....	April 16	1,0
.....	Dec. 18	1,447,193,594	165,000	331,768	.....	Oct. 23	1,282,476,855	146,000	293,731	285,000	Dec. 13	1,1
.....	Nov. 13	1,311,738,004	149,000	262,860	.....	Nov. 19	1,148,886,380	130,800	229,314	.....	Oct. 5	1,0
5,800	(o) Dec.	1,251,104,868	142,800	(A) 253,000	.....	(A) Dec.	1,176,653,000	133,900	(A) 203,002	.....	(A) Dec.	9
0,123	Oct. 22	1,246,330,283	142,100	.....	178,016	Dec. 13	1,047,466,830	119,200	.....	(G) 154,044	.....	8
1,000	Nov. 13	1,203,652,405	137,400	252,000	249,000	Dec. 4	1,052,549,327	119,800	213,000	.....	Nov. 9	9
0,772	May 14	1,198,947,711	137,000	232,980	230,000	Dec. 17	1,102,278,322	125,500	225,919	225,804	Sept. 20	9
7,125	.....	1,146,516,743	130,900	.....	223,700	.....	909,962,847	103,500	.....	185,000	(n) Oct.	6
.....	Oct. 7	1,041,388,668	118,900	252,777	.....	Nov. 2	857,209,496	97,600	224,508	.....	Dec. 19	7
.....	.....	969,071,015	110,700	.....	.....	.....	908,760,906	103,500	.....	.....	.....	8
.....	Dec. 13	941,992,205	107,500	169,219	.....	Dec. 20	877,953,546	100,000	158,453	155,453	Dec. 21	7
6,000	(o) Dec. 11	910,934,486	104,000	.....	(b) 167,900	(o) Dec. 20	825,430,643	94,000	.....	(c) 165,000	Nov. 21	7
2,505	(o) Nov.	882,360,000	100,700	(A) 132,390	.....	(A) Dec.	830,862,000	94,600	(A) 118,678	.....	(A) Sept.	7
2,735	(o) March	858,353,000	97,900	.....	.....	.....	746,709,000	85,000	128,120	113,570	Dec. 28	6
7,600	Aug. 21	819,723,857	93,500	152,200	145,300	March 9	730,061,103	83,100	137,800	129,000	Jan. 27	6
8,320	July 9	735,612,022	83,900	(i) 150,000	(b) 143,500	Dec. 5	645,621,149	73,500	(i) 140,000	(b) 132,350	June 28	7
1,000	Dec. 6	722,998,796	82,500	153,200	152,000	Dec. 10	639,415,709	72,800	133,300	132,400	Dec. 21	5
.....	.....	692,070,936	79,000	.....	.....	.....	567,869,411	64,600	.....	.....	.....	3
.....	.....	665,625,000	76,000	(A) 67,494	.....	(A) Oct.	381,404,000	43,400	.....	.....	.....	2
2,400	Dec. 17	645,165,032	73,600	127,300	120,300	Dec. 21	584,714,544	66,600	.....	(h) 120,806	(m) Dec. 15	4
4,800	(n) May 21	634,346,780	72,500	.....	(o) 132,233	Oct. 23	606,647,383	69,100	.....	(b) 113,234	Feb. 15	5
4,900	(o) Aug. 20	611,482,217	69,800	.....	(b) 111,800	(o) Dec. 18	559,090,541	63,700	.....	(c) 98,700	(o) July 27	4
9,600	Nov. 19	610,962,200	69,750	(i) 129,000	(c) 124,500	Dec. 5	655,035,700	74,600	(i) 127,000	(c) 120,200	Dec. 9	6
3,600	(o) Jan. 4	603,423,300	68,800	.....	(b) 128,500	(o) Jan. 6	549,922,100	62,600	.....	(b) 120,900	Dec. 30	4
3,915	Dec. 17	580,426,439	66,250	.....	.....	.....	445,804,848	50,800	.....	.....	.....	3
8,300	.....	542,629,220	61,900	.....	105,000	(n) Dec. 12	491,171,956	55,800	.....	.....	.....	.....
.....	Jan. 22	538,734,000	61,400	91,560	.....	Oct. 29	454,600,000	51,800	90,110	.....	Dec. 13	3
3,700	(o) Sept.	514,989,108	58,700	.....	100,020	(n) Dec. 14	458,973,651	52,300	.....	(c) 81,400	(o) Dec. 19	3
0,464	(o) Oct.	511,225,000	58,300	(A) 92,553	.....	(A) Oct.	390,533,000	44,400	.....	.....	.....	2
6,205	(o) Oct.	510,247,000	58,200	(A) 82,600	.....	(A) Oct.	436,633,000	49,700	(A) 75,000	.....	(A) Oct.	3
5,100	Dec. 17	494,805,982	56,400	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,800	Dec. 11	480,970,175	54,800	.....	95,100	(n) Dec. 7	440,886,606	50,200	.....	(a) 88,200	Dec. 9	4
8,000	(o) Nov.	476,878,300	54,400	(A) 107,000	.....	(A) Oct.	430,427,600	49,000	(A) 101,000	.....	(A) Dec.	4
1,114	(o) Nov.	471,732,000	53,800	(A) 72,080	.....	(A) Nov.	506,009,000	57,600	(A) 70,245	.....	(A) Dec.	3
3,400	June 3	464,339,110	53,000	82,400	82,400	June 9	528,895,495	60,200	.....	.....	.....	.....
8,000	Dec. 11	449,794,685	51,300	110,500	108,000	Nov. 26	413,992,663	47,100	101,000	98,500	Dec. 19	3
2,780	(o) Sept.	442,818,000	50,500	(A) 92,620	.....	(A) Sept.	374,563,000	42,700	(A) 84,200	.....	(A) Sept. 14	3
3,900	Oct. 17 (I)	430,779,000	(I) 97,500	.....	.....	.....	.....	.....	.....	.....	.....	.....
7,736	(o) May	427,848,189	48,800	(A) 80,696	.....	(A) Aug.	416,134,000	47,400	(A) 77,950	.....	(A) Nov.	4
3,170	.....	424,300,963	48,400	.....	(c) 84,205	(o) Dec.	383,337,429	43,600	74,100	74,000	Sept. 7	3
.....	Dec. 12	410,083,711	46,800	.....	.....	.....	441,845,615	50,300	.....	.....	.....	3
3,023	Dec. 17	393,506,327	44,900	84,900	(o) 75,290	Nov. 19	376,764,523	42,900	80,150	71,670	Nov. 28	3
2,8												

45	Indiana & Michigan Electric Company	45	.....	(b) 123,700	(o) Sept.	514,989,108	58,700	.....	.....	.....	.....	10
45	The Toledo Edison Company	46	.....	(c) 118,464	(o) Oct.	511,225,000	58,300	(A) 92,553	.....	(A) Oct.	3	

Generating and Distributing
4—1929

yearly output in excess of 100,000,000 kw.-hr. during 1929

	1926			1925			1924			
utput for Year Kw.-Hr. (Including Purchased Energy)	Peak Load Kw. (Instantaneous)	Date of Instantaneous Peak	Output for Year Kw.-Hr.	Peak Load Kw. (Instantaneous)	Date of Instantaneous Peak	Output for Year Kw.-Hr.	Peak Load Kw. (Instantaneous)	Date of Peak	Output for Year Kw.-Hr.	Line No.
(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
										1
2,877,090,621	731,964	Dec. 20	2,554,025,704	656,312	Dec. 21	2,262,620,409	615,283	Dec. 23	2,056,432,473	2
3,778,380,000	897,000	Dec. 15	3,482,632,000	809,000	Dec. 23	3,091,424,000	717,000	Dec. 19	2,787,090,000	3
2,421,357,098	422,700	Nov. 9	2,227,879,772	395,900	July 22	1,987,661,654	330,660	March 10	1,664,151,512	4
1,860,613,091	444,000	Dec. 20	1,749,016,316	387,200	Dec. 10	1,521,639,979	334,048	Dec. 22	1,313,297,283	5
2,322,015,035	406,970	Dec. 22	2,157,886,980	380,084	Nov. 4	2,001,474,640	343,701	Dec. 19	1,887,113,680	6
2,142,549,100	439,000	Sept. 15	2,025,063,700	391,000	Oct. 2	1,732,420,700	335,800	Nov. 21	1,460,631,400	7
1,701,886,359	415,000	Dec. 13	1,560,801,782	367,048	Dec. 9	1,358,318,172	335,689	Dec. 22	1,198,240,840	8
1,745,776,428	(c) 337,040	(o) Dec. 13	1,433,759,975	(c) 297,705	(o) Jan. 12	1,187,872,330	(o) 287,000	Dec. 16	1,054,909,770	9
1,727,565,353	(b) 313,040	(o) Dec. 8	1,514,609,984	.....	.....	1,316,521,920	.....	.....	1,196,885,215	10
1,449,881,883	278,121	Dec. 8	1,337,733,243	258,623	Dec. 15	1,200,506,087	.....	.....	.....	11
1,759,143,119	.....	.....	.....	.....	.....	.....	.....	.....	.....	12
1,104,515,942	(c) 179,200	(o) Oct. 20	716,087,950	(c) 165,200	(o) Jan. 20	681,696,046	(o) 151,200	Dec. 2	562,802,440	13
1,351,590,977	251,660	July	1,334,964,749	.....	.....	.....	.....	.....	.....	14
1,366,997,834	188,400	Oct. 15	1,379,194,095	172,600	Aug. 14	1,234,052,127	159,150	Dec. 15	1,121,245,976	15
1,328,526,578	284,260	Dec. 15	1,332,033,978	271,200	Dec. 16	1,230,292,597	239,380	Dec. 16	1,093,939,801	16
1,131,133,000	202,000	Oct. 20	1,109,315,094	(n) 181,600	(n) Dec. 22	890,509,813	.....	.....	.....	17
1,095,378,000	205,000	Oct. 20	975,664,102	.....	.....	.....	.....	.....	.....	18
1,138,838,831	287,119	Dec. 15	1,118,294,193	251,375	Dec. 17	989,409,700	227,954	Dec. 10	865,079,266	19
1,026,886,645	210,420	Dec. 15	959,430,412	203,904	Dec. 4	849,064,272	156,179	Dec. 16	595,329,699	20
908,579,200	194,402	Nov.	858,001,300	130,403	Dec.	707,995,258	135,335	Dec. 22	630,923,200	21
884,762,116	(n,G) 139,809	(n) Dec. 13	720,018,554	(d) 166,390	Dec. 9	(f) 615,092,925	(D) 115,392	Dec. 5	(E) 514,065,402	22
936,704,222	.....	.....	.....	.....	.....	.....	.....	.....	.....	23
930,285,847	118,113	Nov. 9	809,134,896	157,332	Sept. 15	686,548,440	146,789	Dec. 5	602,152,714	24
697,306,888	.....	.....	.....	.....	.....	.....	.....	.....	.....	25
748,502,053	190,276	Dec. 17	673,760,354	203,199	Dec. 1	648,078,358	167,929	Nov. 24	564,459,887	26
839,375,628	181,677	Dec. 6	805,380,692	168,659	Dec. 2	742,601,203	156,619	Dec. 5	691,090,810	27
787,258,688	135,665	Dec. 20	708,450,887	131,468	Dec. 10	632,626,358	125,000	Dec. 19	607,067,218	28
786,877,691	(c) 162,500	(o) Dec. 21	802,768,634	(b) 160,700	(o) Dec. 21	718,195,433	143,500	Dec. 23	648,307,210	29
784,402,000	120,270	Dec.	801,444,000	112,343	Dec.	744,186,000	105,544	Dec.	749,653,000	30
633,019,740	103,783	Dec. 22	571,833,994	107,030	Oct. 30	515,523,750	91,824	Dec. 19	426,053,680	31
651,397,468	136,800	Jan. 12	653,812,207	155,000	Dec. 11	654,488,668	112,500	Dec. 10	477,593,985	32
782,173,960	150,000	Oct. 20	937,689,159	.....	.....	.....	.....	.....	.....	33
584,279,702	121,700	Dec. 3	521,136,258	109,860	Dec. 16	479,878,822	101,162	Dec. 22	437,209,701	34
399,543,412	54,942	Nov. 29	207,140,920	45,000	Nov. 24	156,979,298	36,456	Nov. 15	129,946,323	35
241,723,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	36
488,156,281	(h) 73,200	(m) Oct. 19	365,170,871	(m) 71,000	Dec. 4	339,117,030	(m) 67,723	Dec. 4	315,582,737	37
574,290,447	(c) 120,667	Dec. 22	543,152,601	(i) 100,000	.....	417,368,862	75,000	.....	341,939,101	38
495,593,161	(b) 107,400	(o) Jan. 15	535,078,389	106,100	Dec. 2	522,063,648	121,000	Dec. 3	417,544,531	39
634,248,100	(i) 120,000	June 22	631,681,400	115,000	Nov. 13	513,962,900	98,200	April 16	487,859,000	40
495,663,700	(h) 121,300	Dec. 17	476,272,500	(c) 105,500	(o) Dec. 18	421,155,600	(o) 91,600	(o) Dec. 19	394,013,720	41
354,047,654	(b) 69,870	(o) Dec. 15	286,218,156	(b) 68,270	.....	287,165,218	.....	.....	227,558,428	42
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43
390,808,000	91,490	Nov. 16	318,395,010	(b) 58,390	(o) Dec. 1	180,932,804	(o) 33,300	(o) Dec. 11	133,329,990	44
382,228,176	77,400	May 26	350,695,351	(k) 81,500	Oct. 21	350,518,281	77,000	Dec. 15	279,848,936	45
250,542,000	34,000	Dec.	122,937,000	.....	.....	.....	.....	.....	.....	46
362,094,000	56,000	Dec.	263,299,360	39,250	Dec.	199,847,650	33,100	Nov. 25	161,307,120	47
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	48
409,680,096	(n) 82,300	(n) Dec. 9	377,662,174	(n) 79,440	(n) Dec. 15	304,400,743	.....	Dec. 23	276,663,178	49
426,426,000	(L) 95,000	.....	(L) 426,399,670	46,000	Nov.	160,646,601	25,000	Dec.	100,538,848	50
352,253,000	47,990	Aug.	266,320,000	38,555	Aug.	198,959,000	48,238	May	218,464,000	51
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52
383,128,587	91,500	Dec. 15	350,024,224	84,000	Dec. 16	318,700,406	77,000	Dec. 23	286,695,035	53
355,707,000	76,300	Dec.	339,468,000	57,830	Sept.	264,399,000	53,400	Sept. 4	262,187,000	54
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	55
401,856,000	86,410	Oct.	399,825,337	75,484	Oct.	364,574,445	(o) 68,375	Sept. 29	340,181,750	56
305,326,889	80,070	Dec. 18	334,518,201	74,800	Dec. 8	262,971,086	.....	.....	.....	57
374,724,290	67,040	Dec. 6	293,010,721	67,180	Oct. 20	251,310,788	36,222	Dec. 10	180,554,058	58
352,809,582	77,680	Dec. 1	326,148,706	72,070	Dec. 21	296,678,980	62,069	Dec. 12	267,223,754	59

100,020	(n) Dec. 14	458,973,651	52,300	.....	(c) 81,400	(o) Dec. 19	382,228,176	77,400	May 26	350,695,351 (k) 8
.....	(A) Oct.	390,533,000	44,400	.....	.....	.....	250,542,000	34,000	Dec.	122,937,000 .....

45	The Toledo Edison Company	45		(b)	123,700	(o)	Sept.		514,989,108		58,700								
46	Louisiana Power & Light Company	46		(o)	110,464	(o)	Oct.		511,225,000		58,300	(A)	92,553						
47	Houston Lighting & Power Company	47		(o)	96,205	(o)	Oct.		510,247,000		58,200	(A)	82,600						
48	Western Massachusetts Companies System*	48		(c)	105,100		Dec.	17	494,805,982		56,400								
49	Virginia Electric & Power Company	49	(i) 105,000	(a)	101,800		Dec.	11	480,970,175		54,800								
50	Carolina Power & Light Company	50		(o)	108,000	(o)	Nov.		476,878,300		54,400	(A)	107,000						
51	Idaho Power Company	51		(o)	71,114	(o)	Nov.		471,732,000		53,800	(A)	72,080						
52	Hetch Hetchy Water Supply City & County of San Francisco	52	83,400		83,400		June	3	464,339,110		53,000		82,400						
53	Potomac Electric Power Company	53	120,000		118,000		Dec.	11	449,794,685		51,300		110,500						
54	Texas Power & Light Company	54		(o)	102,780	(o)	Sept.		442,818,000		50,500	(A)	92,620						
55	State Line Generating Company	55	165,400		163,900		Oct.	17	(I) 430,779,000	(I)	97,500								
56	Minnesota Power & Light Company	56		(o)	87,736	(o)	May		427,848,189		48,800	(A)	80,696						
57	Central Indiana Power Company Subsidiaries	57		(b)	93,170				424,300,963		48,400			(c)					
58	The California Oregon Power Company	58	94,575				Dec.	12	410,083,711		46,800								
59	Rochester Gas & Electric Corporation	59	91,523	(c)	83,023		Dec.	17	393,506,327		44,900		84,900	(o)					
60	Indianapolis Power & Light Company	60			82,800				388,871,320		44,400		76,600						
61	Northern Ohio Power & Light Company	61			81,100		Aug.	6	384,412,400		43,800								
62	New York State Electric & Gas Corporation* (R)	62							377,746,958		43,100								
63	Columbus Electric & Power Company and Subsidiaries	63	88,250						370,871,354		42,300		74,890						
64	Central Illinois Public Service Company	64			86,300		Dec.	10	367,912,947		41,900			(c)					
65	City of Seattle, Light & Power Department	65	90,000		80,000		Oct.	10	364,959,930		41,600		76,800						
66	Pennsylvania Electric Company*	66	47,335						364,412,911		41,600								
67	The Hartford Electric Light Company	67		(b)	55,900	(o)	Dec.	17	362,855,320		41,500								
68	New Orleans Public Service, Inc.	68		(o)	68,000	(o)	Jan.		345,847,000		39,500	(A)	68,000						
69	Montaup Electric Company	69	112,000		101,000		Dec.	2	338,215,600		38,600								
70	Northern Indiana Public Service Company	70			66,928	(n)	Dec.	11	334,913,629		38,200								
71	Louisville Gas & Electric Company (Del.) Subsidiaries	71							328,598,520		37,500								
72	Public Service Company of Colorado	72		(b)	72,453	(o)	Dec.	17	319,607,394		36,400		67,797						
73	The Columbus Railway, Power & Light Company	73	70,000		70,000		Dec.		315,558,310		36,000		63,000						
74	Arkansas Power & Light Company	74							310,955,000		35,500								
75	Los Angeles Gas & Electric Corporation	75	90,000		90,000		Dec.	30	304,100,629		34,700		81,500						
76	Interstate Public Service Company	76		(b)	61,175				303,769,447		34,700			(c)					
77	The Nevada-California Electric Corporation System* (S)	77			55,800		July	8	300,320,585		34,200								
78	Wisconsin Power & Light Company	78	61,000		60,784		Dec.	16	296,527,833		33,900								
79	Birmingham Electric Company	79		(o)	54,820	(o)	Dec.		292,759,162		33,400	(A)	53,720						
80	United Illuminating Company (O)	80	76,500				Dec.		288,417,200		32,900			(B)					
81	Northwestern Electric Company	81		(o)	56,000	(o)	Dec.		286,529,056		32,700	(A)	53,100						
82	Kansas Gas & Electric Company	82		(o)	62,400	(o)	Nov.		284,354,000		32,500	(A)	49,900						
83	Gulf States Utilities Company	83	48,998		47,000		June	24	273,182,834		31,100		42,380						
84	Central Maine Power Company	84		(b)	53,045	(o)	Oct.	2	270,606,693		30,900		53,200						
85	Nebraska Power Company	85		(o)	55,000	(o)	July		265,901,500		30,300	(A)	47,000						
86	The Empire District Electric Company	86		(b)	60,600	(o)	April	24	258,682,003		29,500		55,500						
87	City of Tacoma, Light Division, Dept. Public Utilities	87	55,000		54,300		Feb.	12	255,771,531		29,200		49,000						
88	Public Service Company of Oklahoma	88	47,000				Oct.	15	255,220,126		29,100			(c)					
89	Pacific Power & Light Company	89							251,759,000		28,700								
90	West Texas Utilities Company	90	(i) 41,000		39,000		Oct.	9	246,515,315		28,200			(c)					
91	Illinois Electric Power Company	91	56,650		55,000		Oct.	30	246,321,037		28,000		54,190						
92	Kentucky Utilities Company	92	(e) 60,000						240,724,354		27,500			(c)					
93	The Scranton Electric Company	93	58,200				Dec.	31	240,508,000		27,400		52,400						
94	Central Power & Light Company	94	(A) 42,800			(A)	Aug.		239,756,655		27,300			(c)					
95	San Antonio Public Service Company	95	53,400		51,600		Dec.	20	238,200,935		27,200								
96	Penn Central Light & Power Company	96	51,550		50,300		March	3	237,817,248		27,200		45,950						
97	New Bedford Gas & Edison Light Company	97	58,800		58,000		Dec.	10	219,020,744		25,000		58,800						
98	Westchester Lighting Company	98	50,600		50,200		Dec.	24	216,503,601		24,700		45,200						
99	Kentucky & West Virginia Power Company, Inc.	99	11,800				July	2	211,444,000		24,100		11,000						
100	Blackstone Valley Gas & Electric Company	100		(b)	55,515		Dec.	2	207,701,144		23,700			(c)					
101	Florida Power & Light Company	101		(o)	59,208	(o)	Feb.		202,110,030		23,000	(A)	60,708						
102	Central Hudson Gas & Electric Corporation	102	56,500		55,400		April	21	200,566,867		22,900		55,000						
103	Dallas Power & Light Company	103		(o)	55,400	(o)	Sept.		199,099,200		22,700	(A)	46,400						
104	City of Cleveland, Division of Light & Power	104	38,300				Dec.	23	198,179,340		22,600		37,200						
105	Long Island Lighting Company and Subsidiaries	105	58,200		48,000		Sept.	7	197,097,106		22,500		54,935						
106	Salt River Valley Water Users' Association	106	46,315				May	15	188,665,617		21,500		55,200						
107	San Diego Consolidated Gas & Electric Company	107	45,300				Dec.	2	185,639,011		21,200								
108	Atlantic City Electric Company	108	48,000				Aug.	17	184,172,000		21,000		41,500						
109	Memphis Power & Light Company	109		(o)	45,000	(o)	Dec.		182,112,000		20,800	(A)	41,261						
110	Indiana Service Corporation	110	41,000				Dec.	20	180,016,985		20,500		45,000						
111	Central Illinois Light Company	111	40,900		39,400		Dec.	12	177,338,443		20,200		(K)						
112	Wisconsin Public Service Corporation and Subsidiary	112	50,400				Nov.	26	176,194,115		20,100								
113	Des Moines Electric Light Company	113			42,500	(n)	Nov.	12	172,539,101		19,700								
114	U. S. Government (Muscle Shoals)	114	116,260		112,500		Aug.	24	171,681,600		19,500		130,000						
115	Tampa Electric Company	115			33,000		Dec.	17	170,887,397		19,400		31,720						
116	Moline-Rock Island Manufacturing Company	116	40,480		40,000		Dec.	11	164,206,522		18,700		35,030						
117	Sioux City Gas & Elec. Co., Iowa Pub. Serv. Co. System	117	42,400		40,500		Dec.		162,477,080		18,500								
118	Broad River Power Company	118	(i) 55,000	(c)	53,200		Sept.	12	162,129,679		18,500	(i)	60,000	(b)					
119	Southwestern Gas & Electric Company	119							149,696,794		17,000			(c)					
120	Indiana General Service Company	120	23,620				May	2	145,405,000		16,600		26,480						
121	Cumberland County Power & Light Company	121	41,510		41,940		Dec.	10	144,364,260		16,400		31,380						
122	Terre Haute, Indianapolis & Eastern Traction Company	122							143,058,177		16,300								
123	Edison Electric Company of Lancaster, Pa.	123		(o)	31,800	(o)	Dec.		140,850,741		16,080	(A)	32,060						
124	South Carolina Power Company*	124			29,440				136,213,088		15,500								
125	Delaware Power & Light Company*	125	31,200		29,700		Dec.	11	134,571,700		15,360		24,500						
126	Staten Island Edison Corporation	126	37,000		31,800		Nov.	13	128,665,860		14,650		32,600						
127	Salem Electric Lighting Company	127	29,400		29,400		Dec.	5	127,820,205		14,500		30,500						
128	Erie Lighting Company*	128	37,300						126,624,123		14,400								
129	Kansas Power & Light Company	129			27,800	(n)	Oct.	23	122,992,015		14,000								
130	Wheeling Electric Company	130							119,716,000		13,660								
131	Mississippi Power Company*	131			30,300				116,745,731		13,300								
132	Luzerne County Gas & Electric Corporation	132	29,610		26,810		Dec.	17	115,530,335		13,200								
133	Mountain States Power Company and Subsidiaries	133							112,617,618		12,860								
134	Knoxville Power & Light Company	134		(o)	23,065	(o)	Dec.		111,870,280		12,700								
135	United Power & Light Corporation (of Kansas)	135			23,230	(n)	Dec.	7	103,802,181		11,850								

700	(o)	Sept.	514,989,108	58,700		100,020	(n)	Dec. 14	458,973,651		52,300		(c)	81,400	(o)	Dec. 19		382,22	

100,020	(n)	Dec. 14	458,973,651	52,300			(c)	81,400	(o)	Dec. 19	382,228,176	77,400		May 26	350,695,351	(k)	81		
	(A)	Oct.	390,533,000	44,400							250,542,000	34,000		Dec.	122,937,000				
	(A)	Oct.	436,633,000	49,700	(A)	75,000			(A)	Oct.	362,094,000	56,000		Dec.	263,299,360				39
95,100	(n)	Dec. 7	440,886,606	50,200			(a)	88,200		Dec. 9	409,680,096	(n) 82,300	(n)	Dec. 9	377,662,174	(n)	79		
	(A)	Oct.	430,427,600	49,000	(A)	101,000			(A)	Dec.	426,426,000	(L) 95,000			(L) 426,399,670		46		
	(A)	Nov.	506,009,000	57,600	(A)	70,245			(A)	Dec.	352,253,000	47,990		Aug.	266,320,000		38		
82,400		June 9	528,895,495	60,200															
108,000		Nov. 26	413,992,663	47,100		101,000		98,500		Dec. 19	383,128,587	91,500		Dec. 15	350,024,224		84		
	(A)	Sept.	374,563,000	42,700	(A)	84,200			(A)	Sept. 14	355,707,000	76,300		Dec.	339,468,000		57		
	(A)	Aug.	416,134,000	47,400	(A)	77,950			(A)	Nov.	401,856,000	86,410		Oct.	399,825,337		75		
c) 84,205	(o)	Dec.	383,337,429	43,600		74,100		74,000		Sept. 7	305,326,889	80,070		Dec. 18	334,518,201		74		
			441,845,615	50,300							374,724,290	67,040		Dec. 6	293,010,721		62		
b) 75,290		Nov. 19	376,764,523	42,900		80,150		71,670		Nov. 28	352,809,582	77,680		Dec. 1	326,148,706		72		
76,600		Dec. 4	356,228,046	40,600				63,500			328,712,384								
80,300			378,609,988	43,100				79,740			379,630,884	(n) 45,500			356,040,480	(n)	4		
		April 5	308,177,094	35,100		74,220		73,000		May 25	260,726,212	69,540		June 23	257,540,000		5		
c) 66,300	(o)	Nov.	339,189,800	38,600				72,600	(n)	Dec. 6	301,548,168	(n) 74,600	(n)	Dec. 21	278,626,089		6		
75,000		Dec. 4	307,909,700	35,050		75,000		75,000		Dec. 9	277,591,025	64,800		Dec. 14	232,848,275		5		
52,500	(n)	Dec. 17	242,563,000	27,600			(G)	51,300		Feb. 17	220,324,000	67,000		Aug. 26	192,253,000		5		
	(A)	Dec.	338,629,000	38,600	(A)	66,500			(A)	Oct.	319,842,000	66,000		Dec.	222,927,000		6		
52,094			302,031,809	34,400				44,990		Nov. 30	271,440,543	(n) 44,750	(n)	Dec. 8	227,490,211		3		
			285,767,900	32,500							234,238,160				222,310,255		5		
		Dec. 12	298,387,145	34,000			(c)	63,980			285,892,553	67,080		Dec. 14	268,618,910		5		
60,000		Dec. 18	283,654,155	32,300				55,100		Dec. 8	254,843,000								
			259,164,000	29,500							183,843,000	43,500		Dec.	151,908,790				
81,500		Dec. 27	269,681,600	30,700		74,000		74,000		Dec. 21	247,191,413	68,200		Dec. 23	213,459,806		5		
c) 35,628	(o)	Feb.	272,698,429	31,050		58,600		46,880		Oct. 20	(s) 237,227,562	57,800		Nov. 4	(s) 243,812,849				
51,900	(n)	July 24	294,781,380	33,550		57,600				July 13	279,334,470	50,200		June 30-July 1 & 2	273,230,332		4		
			283,520,629	32,300		(N)		(N)		(N)	275,376,599	62,000		Dec. 7	258,765,399				
	(A)	Aug.	298,379,513	34,000	(A)	53,811			(A)	Dec.	289,073,000	41,692		Oct.	200,750,534		3		
B) 34,500	(B)	Dec. 3	275,965,650	31,400							222,132,700	31,000		Nov.	115,535,700				
	(A)	Dec.	286,820,000	32,650	(A)	48,100			(A)	Dec.	255,766,000	44,400		Dec.	237,403,000		3		
	(A)	Dec.	249,717,000	28,400	(A)	44,600			(A)	Dec.	221,118,000	44,400		Dec.	194,417,500		3		
35,204	S. 5; (n)	D. 20	191,081,273	21,750		29,754		27,500		July 20	155,783,691	(i) 22,000	(l)	Dec. 2	100,344,073				
53,200		Dec. 20	240,169,182	27,400			(b)	48,600	(o)	Dec. 16	220,727,440	(c) 43,800	(o)	Dec. 17	183,268,485	(q)	62		
	(A)	Sept.	219,813,000	25,000	(A)	41,900			(A)	Dec. 21	201,094,000	38,800		Sept. 22	187,052,800		3		
		Aug. 8	226,034,240	25,700			(c)	61,000	(o)	Aug. 31	262,409,515	62,280		Nov. 23	214,669,321		5		
49,000		Dec. 19	208,399,465	23,700		61,500		61,500		Dec. 30	197,580,149	55,000		Oct. 11	195,791,000		3		
c) 46,000	(o)	Oct.	224,426,315	25,550	(i)	39,222		35,300		Dec. 8	135,199,859								
			232,877,000	26,500	(A)	35,105			(A)	Dec.	171,611,000	27,677		Dec.	166,214,470	(i)	3		
c) 44,220	(o)	Dec.	147,963,154	16,840															
53,000		July 3	228,660,184	26,000		53,010		52,000		Dec. 7	213,752,872	43,000		Aug. 20	165,088,310				
c) 39,910	(o)	July	194,822,819	22,200		45,800		44,000		Dec. 5	185,904,592	(i) 34,100	(i)	Dec. 21	146,560,259				
		Dec. 14	245,526,000	27,950		51,000				Feb. 15	237,512,000	54,020		Nov. 22	214,065,156		4		
c) 34,845	(o)	Nov.	146,744,975	16,700				25,205			120,521,353								
45,800		Oct. 30	213,808,418	24,300				45,000			226,892,235	62,500		Nov. 30	227,630,419				
56,000		Dec. 20	167,613,529	19,080		50,500		48,000		Jan. 4	173,617,378	52,600		Dec. 20	172,222,651				
45,150		Dec. 24	171,315,819	19,500								32,980		Dec. 15	126,197,021				
		July 9	194,912,000	22,200		9,800				Aug. 8	168,960,000	10,000		April 13	137,256,705				
c) 54,970	(o)	Dec. 20	182,918,142	20,800			(c)	52,200	(o)	Dec. 7	165,318,271	(b) 51,792	(o)	Nov. 30	153,976,958				
	(A)	Jan.	199,322,000	22,700	(A)	65,364			(A)	Jan. 12	214,167,000	64,000		Feb.	173,623,725				
53,000		Nov. 2	213,612,676	24,300			(o)	52,900	(o)	Dec. 15	222,368,156								
	(A)	Dec. 21	179,165,000	20,400	(A)	44,300			(A)	Dec. 23	171,925,970	35,100		Nov.	159,430,750				
		Dec. 21	186,242,950	21,200		33,700		33,700		Dec. 19	174,146,677				164,932,820	(n)			
50,000		Dec. 29	172,923,000	19,700		49,000					135,372,000	38,000			108,600,000				
		June 4	275,550,594	31,400		53,275				Aug. 24	206,356,017	24,750		Sept. 3	113,107,669				
			153,825,600	17,500							126,801,100	31,900		Nov. 1	123,369,160				
		Aug. 28	148,331,000	16,900		36,000				Sept. 3	157,892,000	29,000		Sept. 4	106,141,300				
	(A)	Dec.	172,781,000	19,670	(A)	46,000			(A)	Dec.	166,244,000	36,392		Dec.	137,786,000				
40,000		Dec. 17	152,957,600	17,400		34,000		34,000		Nov. 30	131,861,909	32,900		Dec. 13	123,632,339				
(K)	(K)		156,467,174	17,810		31,727		29,500		Dec. 15	135,692,265	28,600		Dec. 21	117,679,234				
			149,811,913	17,060							153,364,676	(c) 33,200	(o)	Nov. 17	150,635,115				
36,000			159,666,072	18,180		40,000		36,400			134,416,934	32,000		Nov. 8	128,293,150				
120,600		Feb. 14	222,096,800	25,300		125,540		120,185		Nov. 29	565,609,500	106,400		Nov. 11	439,380,300				
		Sept. 21	152,885,453	17,400		25,340				Jan. 1	114,195,401	(n) 27,620	(n)	Dec. 7	100,462,550				
34,750		Oct. 17	151,902,906	17,300		31,570		31,000		Nov. 28	131,017,494	32,530		Sept. 14	124,713,651				
b) 54,800		Dec. 31	148,932,217	16,950															
c) 31,790	(o)	Nov.	119,647,273	13,600															
		March 13	122,579,000	13,950		24,600				Nov. 20	105,634,000	23,140		Dec. 8	104,648,573				
30,200		Dec. 17	114,835,060	13,070				30,580			116,194,720				107,971,800				
			135,476,900	15,400															
	(A)	Dec.	143,646,000	16,340	(A)	30,200			(A)	May 19	135,474,100	(c) 28,850			125,911,263	(t)			
23,500		Jan. 4	122,337,055	13,930			(o)	25,000	(o)	Dec. 21	109,786,578	22,500		Aug. 13	111,341,210				
28,100		Nov. 26	117,999,180	13,430		29,000	(c)	25,600		Feb. 16	107,715,140	31,500		Feb. 19 and 23	100,957,540				
30,500		Dec. 3	112,097,459	12,760		27,000		27,000		Dec. 16	115,393,187	26,600		Dec. 28	100,874,562				
30,750			108,519,670	12,350															
			104,830,000	11,930															
23,400			93,469,303	10,640				19,000	(n)	Oct.	75,389,189								

382,228,176		77,400	May 26	350,695,351	(k)	81,500		Oct. 21		350,518,281		77,000		Dec. 15	279,848,936		45		

300	155	United Power & Light Corporation (of Kansas)						155											
700	(o)	Sept.		514,989,108		58,700		100,020	(n)	Dec. 14		458,973,651	52,300			(c)	81,400	(o)	Dec. 19	382
464	(o)	Oct.		511,225,000		58,300	(A) 92,553		(A)	Oct.		390,533,000	44,400							250
205	(o)	Oct.		510,247,000		58,200	(A) 82,600		(A)	Oct.		436,633,000	49,700		(A) 75,000			(A)	Oct.	362
100		Dec. 17		494,805,982		56,400														
800		Dec. 11		480,970,175		54,800		95,100	(n)	Dec. 7		440,886,606	50,200			(a)	88,200		Dec. 9	409
000	(o)	Nov.		476,878,300		54,400	(A) 107,000		(A)	Oct.		430,427,600	49,000		(A) 101,000			(A)	Dec.	426
114	(o)	Nov.		471,732,000		53,800	(A) 72,080		(A)	Nov.		506,009,000	57,600		(A) 70,245			(A)	Dec.	352
400		June 3		464,339,110		53,000	82,400	82,400		June 9		528,895,495	60,200							
000		Dec. 11		449,794,685		51,300	110,500	108,000		Nov. 26		413,992,663	47,100		101,000		98,500		Dec. 19	383
780	(o)	Sept.		442,818,000		50,500	(A) 92,620		(A)	Sept.		374,563,000	42,700		(A) 84,200			(A)	Sept. 14	355
900		Oct. 17	(I)	430,779,000	(I)	97,500														
736	(o)	May		427,848,189		48,800	(A) 80,696		(A)	Aug.		416,134,000	47,400		(A) 77,950			(A)	Nov.	401
170				424,300,963		48,400		(c) 84,205	(o)	Dec.		383,337,429	43,600		74,100		74,000		Sept. 7	305
		Dec. 12		410,083,711		46,800						441,845,615	50,300							374
023		Dec. 17		393,506,327		44,900	84,900	(o) 75,290		Nov. 19		376,764,523	42,900		80,150		71,670		Nov. 28	352
800				388,871,320		44,400	76,600	76,600		Dec. 4		356,228,046	40,600				63,500			328
100		Aug. 6		384,412,400		43,800		80,300				378,609,988	43,100				79,740			379
				377,746,958		43,100														
				370,871,354		42,300	74,890			April 5		308,177,094	35,100		74,220		73,000		May 25	260
300		Dec. 10		367,912,947		41,900		(c) 66,300	(o)	Nov.		339,189,800	38,600				72,600	(n)	Dec. 6	301
000		Oct. 10		364,959,930		41,600	76,800	75,000		Dec. 4		307,909,700	35,050		75,000		75,000		Dec. 9	277
				364,412,911		41,600														
900	(o)	Dec. 17		362,855,320		41,500		52,500	(n)	Dec. 17		242,563,000	27,600			(G)	51,300		Feb. 17	220
000	(o)	Jan.		345,847,000		39,500	(A) 68,000		(A)	Dec.		338,629,000	38,600		(A) 66,500			(A)	Oct.	319
000		Dec. 2		338,215,600		38,600														
928	(n)	Dec. 11		334,913,629		38,200		52,094				302,031,809	34,400				44,990		Nov. 30	271
				328,598,520		37,500						285,767,900	32,500							234
453	(o)	Dec. 17		319,607,394		36,400	67,797			Dec. 12		298,387,145	34,000			(c)	63,980			285
000		Dec.		315,558,310		36,000	63,000	60,000		Dec. 18		283,654,155	32,300				55,100		Dec. 8	254
				310,955,000		35,500						259,164,000	29,500							183
000		Dec. 30		304,100,629		34,700	81,500	81,500		Dec. 27		269,681,600	30,700		74,000		74,000		Dec. 21	247
175				303,769,447		34,700		(c) 35,628	(o)	Feb.		272,698,429	31,050		58,600		46,880		Oct. 20	(s) 237
800		July 8		300,320,585		34,200		51,900	(n)	July 24		294,781,380	33,550		57,600				July 13	279
784		Dec. 16		296,527,833		33,900						283,520,629	32,300		(N)		(N)		(N)	275
820	(o)	Dec.		292,759,162		33,400	(A) 53,720		(A)	Aug.		298,379,513	34,000		(A) 53,811			(A)	Dec.	289
		Dec.		288,417,200		32,900		(B) 34,500	(B)	Dec. 3		275,965,650	31,400							222
000	(o)	Dec.		286,529,056		32,700	(A) 53,100		(A)	Dec.		286,820,000	32,650		(A) 48,100			(A)	Dec.	255
400	(o)	Nov.		284,354,000		32,500	(A) 49,900		(A)	Dec.		249,717,000	28,400		(A) 44,600			(A)	Dec.	221
000		June 24		273,182,834		31,100	42,380	35,204	S. 5: (n) D. 20			191,081,273	21,750		29,754		27,500		July 20	155
045	(o)	Oct. 2		270,606,693		30,900	53,200	53,200		Dec. 20		240,169,182	27,400			(b)	48,600	(o)	Dec. 16	220
000	(o)	July		265,901,500		30,300	(A) 47,000		(A)	Sept.		219,813,000	25,000		(A) 41,900			(A)	Dec. 21	201
600	(o)	April 24		258,682,003		29,500	55,500			Aug. 8		226,034,240	25,700			(c)	61,000	(o)	Aug. 31	262
300		Feb. 12		255,771,531		29,200	49,000	49,000		Dec. 19		208,399,465	23,700		61,500		61,500		Dec. 30	197
		Oct. 15		255,220,126		29,100		(c) 46,000	(o)	Oct.		224,426,315	25,550		(i) 39,222		35,300		Dec. 8	135
				251,759,000		28,700						232,877,000	26,500		(A) 35,105			(A)	Dec.	171
000		Oct. 9		246,515,315		28,200		(c) 44,220	(o)	Dec.		147,963,154	16,840							
000		Oct. 30		246,321,037		28,000	54,190	53,000		July 3		228,660,184	26,000		53,010		52,000		Dec. 7	211
				240,724,354		27,500		(c) 39,910	(o)	July		194,822,819	22,200		45,800		44,000		Dec. 5	188
		Dec. 31		240,508,000		27,400	52,400			Dec. 14		245,526,000	27,950		51,000				Feb. 15	233
	(A)	Aug.		239,756,655		27,300		(c) 34,845	(o)	Nov.		146,744,975	16,700				25,205			120
600		Dec. 20		238,200,935		27,200														
300		March 3		237,817,248		27,200	45,950	45,800		Oct. 30		213,808,418	24,300				45,000			22
000		Dec. 10		219,020,744		25,000	58,800	56,000		Dec. 20		167,613,529	19,080		50,500		48,000		Jan. 4	17
200		Dec. 24		216,503,601		24,700	45,200	45,150		Dec. 24		171,315,819	19,500		(See The New York Edison and Allied Comp					
		July 2		211,444,000		24,100	11,000			July 9		194,912,000	22,200		9,800				Aug. 8	16
515		Dec. 2		207,701,144		23,700		(c) 54,970	(o)	Dec. 20		182,918,142	20,800			(c)	52,200	(o)	Dec. 7	16
208	(o)	Feb.		202,110,030		23,000	(A) 60,708		(A)	Jan.		199,322,000	22,700		(A) 65,364			(A)	Jan. 12	21
400		April 21		200,566,867		22,900	55,000	53,000		Nov. 2		213,612,676	24,300			(o)	52,900	(o)	Dec. 15	22
400	(o)	Sept.		199,099,200		22,700	(A) 46,400		(A)	Dec. 21		179,165,000	20,400		(A) 44,300			(A)	Dec. 23	17
		Dec. 23		198,179,340		22,600	37,200			Dec. 21		186,242,950	21,200		33,700		33,700		Dec. 19	17
000		Sept. 7		197,097,106		22,500	54,935	50,000		Dec. 29		172,923,000	19,700		49,000					13
		May 15		188,665,617		21,500	55,200			June 4		275,550,594	31,400		53,275				Aug. 24	20
		Dec. 2		185,639,011		21,200						153,825,600	17,500							12
		Aug. 17		184,172,000		21,000	41,500			Aug. 28		148,331,000	16,900		36,000				Sept. 3	15
000	(o)	Dec.		182,112,000		20,800	(A) 41,261		(A)	Dec.		172,781,000	19,670		(A) 46,000			(A)	Dec.	16
		Dec. 20		180,016,985		20,500	45,000	40,000		Dec. 17		152,957,600	17,400		34,000		34,000		Nov. 30	13
400		Dec. 12		177,338,443		20,200	(K)	(K)		(K)		156,467,174	17,810		31,727		29,500		Dec. 15	13
		Nov. 26		176,194,115		20,100						149,811,913	17,060							15
500	(n)	Nov. 12		172,539,101		19,700		36,000				159,666,072	18,180		40,000		36,400			13
500		Aug. 24		171,681,600		19,500	130,000	120,600		Feb. 14		222,096,800	25,300		125,540		120,185		Nov. 29	56
000		Dec. 17		170,887,397		19,400	31,720			Sept. 21		152,885,453	17,400		25,340				Jan. 1	11
000		Dec. 11		164,206,522		18,700	35,030	34,750		Oct. 17		151,902,906	17,300		31,570		31,000		Nov. 28	13
500		Dec.		162,477,080		18,500														
200		Sept. 12		162,129,679		18,500	(i) 60,000	(b) 54,800		Dec. 31		148,932,217	16,950							
				149,696,794		17,000		(c) 31,790	(o)	Nov.		119,647,273	13,600							
		May 2		145,405,000		16,600	26,480			March 13		122,579,000	13,950		24,600				Nov. 20	10
940		Dec. 10		144,364,260		16,400	31,380	30,200		Dec. 17		114,835,060	13,070				30,580			11
				143,058,177		16,300						135,476,900	15,400							
800	(o)	Dec.		140,850,741		16,080	(A) 32,060		(A)	Dec.		143,646,000	16,340		(A) 30,200			(A)	May 19	13
440				136,213,088		15,500														
700		Dec. 11		134,571,700		15,360	24,500	23,500		Jan. 4		122,337,055	13,930			(o)	25,000	(o)	Dec. 21	10
800		Nov. 13		128,665,860		14,650	32,600	28,100		Nov. 26		117,999,180	13,430		29,000	(c)	25,600		Feb. 16	10
400		Dec. 5		127,820,205		14,500	30,500	30,500		Dec. 3		112,097,459	12,760		27,000		27,000		Dec. 16	11
				126,624,123		14,400														
800	(n)	Oct. 23		122,992,015		14,000		30,750				108,519,670	12,350							
				119,716,000		13,660						104,830,000	11,930							
300				116,745,731		13,300		23,400				93,469,303	10,640				19,000	(n)	Oct.	7
810		Dec. 17		115,530,335		13,200														
				112,617,618		12,860														
065	(o)	Dec.		111,870,280		12,700														
230	(n)	Dec. 7		103,802,181		11,850														
508	(o)	Oct.		103,748,759		11,800														

382,228,176		77,400		May 26		350,695,351	(k)	81,500		Oct. 21		350,518,281		77,000	Dec. 15	279,848,936	45
250,542,000		34,000		Dec.		122,937,000											46
362,094,000		56,000		Dec.		263,299,360		39,250		Dec.		199,847,650		33,100	Nov. 25	161,307,120	47
																	48
409,680,096	(n)	82,300	(n)	Dec. 9		377,662,174	(n)	79,440	(n)	Dec. 15		304,400,743			Dec. 23	276,663,178	49
426,426,000	(L)	95,000			(L)	426,399,670		46,000		Nov.		160,646,601		25,000	Dec.	100,538,848	50
352,253,000		47,990		Aug.		266,320,000		38,555		Aug.		198,959,000		48,238	May	218,464,000	51
																	52
383,128,587		91,500		Dec. 15		350,024,224		84,000		Dec. 16		318,700,406		77,000	Dec. 23	286,695,035	53
355,707,000		76,300		Dec.		339,468,000		57,830		Sept.		264,399,000		53,400	Sept. 4	262,187,000	54
																	55
401,856,000		86,410		Oct.		399,825,337		75,484		Oct.		364,574,445	(o)	68,375	Sept. 29	340,181,750	56
305,326,889		80,070		Dec. 18		334,518,201		74,800		Dec. 8		262,971,086					57
374,724,290		67,040		Dec. 6		293,010,721		67,180		Oct. 20		251,310,788		36,222	Dec. 10	180,554,058	58
352,809,582		77,680		Dec. 1		326,148,706		72,070		Dec. 21		296,678,980		62,069	Dec. 12	267,223,754	59
328,712,384																	60
379,630,884	(n)	45,500				356,040,480	(n)	43,400	(n)	Jan. 27		304,116,460	(n)	47,400	Jan. 9	267,074,055	61
																	62
260,726,212		69,540		June 23		257,540,000		52,040		Nov. 4		204,811,841		38,910	Dec. 5	156,732,805	63
301,548,168	(n)	74,600	(n)	Dec. 21		278,626,089		65,000		Nov. 18		247,311,779		53,500	Dec. 30	202,871,998	64
277,591,025		64,800		Dec. 14		232,848,275		59,600		Dec. 29		218,245,950		50,800	Dec. 9	152,125,000	65
																	66
220,324,000		67,000		Aug. 26		192,253,000		56,400		May 1		190,355,000		54,700	Nov. 19	163,178,438	67
319,842,000		66,000		Dec.		222,927,000		65,000		Dec.		252,735,540		56,000	Dec. 12	226,584,380	68
																	69
271,440,543	(n)	44,750	(n)	Dec. 8		227,490,211		32,796		Dec. 22		170,852,661		28,800	Dec. 23	149,220,978	70
234,238,160						222,310,255		56,250		Dec. 8		217,377,479		48,700	Dec. 23	168,403,952	71
285,892,553		67,080		Dec. 14		268,618,910		58,645		Dec. 22		244,055,341		55,000	Dec. 22	216,151,037	72
254,843,000																	73
183,843,000		43,500		Dec.		151,908,790											74
247,191,413		68,200		Dec. 23		213,459,806		58,300		Dec. 17		184,683,171		69,000	Nov. 5	245,047,430	75
237,227,562		57,800		Nov. 4	(s)	243,812,849											76
279,334,470		50,200	June 30-July 1 & 2			273,230,332		49,900		July 16		260,300,140		40,500	June 7-Oct. 21	226,680,958	77
275,376,599		62,000		Dec. 7		258,765,399											78
289,073,000		41,692		Oct.		200,750,534		35,919		Dec.		224,109,866		37,749	Dec. 10	193,987,141	79
222,132,700		31,000		Nov.		115,535,700											80
255,766,000		44,400		Dec.		237,403,000		39,300		Dec.		196,911,791	(B)	34,500		188,771,500	81
221,118,000		44,400		Dec.		194,417,500		35,800		Dec.		177,590,200		35,200	Dec.	163,783,700	82
155,783,691	(i)	22,000	(l)	Dec. 2		100,344,073											83
220,727,440	(c)	43,800	(o)	Dec. 17		183,268,485	(q)	628,410		Dec. 30		174,943,577	(o)	33,300		154,117,396	84
201,094,000		38,800		Sept. 22		187,052,800		30,500		Oct.		177,233,500		34,700	Dec. 18	166,110,700	85
262,409,515		62,280		Nov. 23		214,669,321		59,260		Jan. 1		178,047,098		41,200	Dec. 17	148,402,996	86
197,580,149		55,000		Oct. 11		195,791,000		33,000		Dec. 29		157,662,360		33,400	Dec. 19	147,218,203	87
135,199,859																	88
171,611,000		27,677		Dec.		166,214,470	(i)	35,000		Aug.		155,585,707				137,304,890	89
																	90
213,752,872		43,000		Aug. 20		165,088,310											91
185,904,592	(i)	34,100	(i)	Dec. 21		146,560,259											92
237,512,000		54,020		Nov. 22		214,065,156		46,300		Aug. 6		197,864,432	(n)	39,800	Dec. 23	164,162,797	93
120,521,353																	94
																	95
226,892,235		62,500		Nov. 30		227,630,419		46,300		Dec. 14		208,994,394		40,100	Dec. 30	165,364,793	96
173,617,378		52,600		Dec. 20		172,222,651		50,300		Dec. 1		155,470,639		48,800	Dec. 22	121,512,151	97
Companies)		32,980		Dec. 15		126,197,021		30,000		Dec. 21		104,207,062					98
168,960,000		10,000		April 13		137,256,705											99
165,318,271	(b)	51,792	(o)	Nov. 30		153,976,958		48,000		Dec. 21		138,876,293	(o)	41,440	Dec. 18	124,813,962	100
214,167,000		64,000		Feb.		173,623,725											101
222,368,156																	102
171,925,970		35,100		Nov.		159,430,750		36,400		Dec.		144,739,433		31,700	Dec. 22	127,924,350	103
174,146,677						164,932,820	(n)	31,000		Dec. 21		151,475,140					104
135,372,000		38,000				108,600,000		30,000				90,300,000		27,000		75,000,000	105
206,356,017		24,750		Sept. 3		113,107,669											106
126,801,100		31,900		Nov. 1		123,369,160		27,300		Dec. 18		117,956,180					107
157,892,000		29,000		Sept. 4		106,141,300											108
166,244,000		36,392		Dec.		137,786,000		34,300		Dec.		121,627,000		31,700	Dec. 22	112,743,000	109
131,861,909		32,900		Dec. 13		123,632,339											110
135,692,265		28,600		Dec. 21		117,679,234		25,800		Sept. 30		106,992,465					111
153,364,676	(c)	33,200	(o)	Nov. 17		150,635,115		30,400		Dec. 4		128,835,193		35,000	Dec.	113,239,516	112
134,416,934		32,000		Nov. 8		128,293,150											113
565,609,500		106,400		Nov. 11		439,380,300											114
114,195,401	(n)	27,620	(n)	Dec. 7		100,462,550											115
131,017,494		32,530		Sept. 14		124,713,651		30,000		Dec. 4		108,316,069					116
																	117
																	118
																	119
105,634,000		23,140		Dec. 8		104,648,573											120
116,194,720						107,971,800											121
																	122
135,474,100	(c)	28,850				125,911,263	(t)	30,300		(u)		118,617,000	(B)	26,400	Dec. 10	107,440,900	123
																	124
109,786,578		22,500		Aug. 13		111,341,210											125
107,715,140		31,500		Feb. 19 and 23		100,957,540											126
115,393,187		26,600		Dec. 28		100,874,562											127
																	128
																	129
																	130
75,389,189																	131
																	132
																	133
																	134
																	135
																	136
																	137

,230	(n)	Dec. 7	103,802,181	11,850									
,508	(o)	Oct.	103,748,759	11,800									

111	Central Illinois Light Company	111	40,900		39,400		Dec. 12	177,338,443	20,200		(K)				
112	Wisconsin Public Service Corporation and Subsidiary	112	50,400				Nov. 26	176,194,115	20,100						
113	Des Moines Electric Light Company	113			42,500	(n)	Nov. 12	172,539,101	19,700						
114	U. S. Government (Muscle Shoals)	114	116,260		112,500		Aug. 24	171,681,600	19,500		130,000				
115	Tampa Electric Company	115			33,000		Dec. 17	170,887,397	19,400		31,720				
116	Moline-Rock Island Manufacturing Company	116	40,480		40,000		Dec. 11	164,206,522	18,700		35,030				
117	Sioux City Gas & Elec. Co., Iowa Pub. Serv. Co. System	117	42,400		40,500		Dec.	162,477,080	18,500						
118	Broad River Power Company	118	(i) 55,000	(c)	53,200		Sept. 12	162,129,679	18,500	(i)	60,000	(b)			
119	Southwestern Gas & Electric Company	119						149,696,794	17,000			(c)			
120	Indiana General Service Company	120	23,620				May 2	145,405,000	16,600		26,480				
121	Cumberland County Power & Light Company	121	41,510		41,940		Dec. 10	144,364,260	16,400		31,380				
122	Terre Haute, Indianapolis & Eastern Traction Company	122						143,058,177	16,300						
123	Edison Electric Company of Lancaster, Pa.	123		(o)	31,800	(o)	Dec.	140,850,741	16,080	(A)	32,060				
124	South Carolina Power Company*	124			29,440			136,213,088	15,500						
125	Delaware Power & Light Company*	125	31,200		29,700		Dec. 11	134,571,700	15,360		24,500				
126	Staten Island Edison Corporation	126	37,000		31,800		Nov. 13	128,665,860	14,650		32,600				
127	Salem Electric Lighting Company	127	29,400		29,400		Dec. 5	127,820,205	14,500		30,500				
128	Erie Lighting Company*	128	37,300					126,624,123	14,400						
129	Kansas Power & Light Company	129			27,800	(n)	Oct. 23	122,992,015	14,000						
130	Wheeling Electric Company	130						119,716,000	13,660						
131	Mississippi Power Company*	131			30,300			116,745,731	13,300						
132	Luzerne County Gas & Electric Corporation	132	29,610		26,810		Dec. 17	115,530,335	13,200						
133	Mountain States Power Company and Subsidiaries	133						112,617,618	12,860						
134	Knoxville Power & Light Company	134		(o)	23,065	(o)	Dec.	111,870,280	12,700						
135	United Power & Light Corporation (of Kansas)	135			23,230	(n)	Dec. 7	103,802,181	11,850						
136	Mississippi Power & Light Company	136		(o)	25,508	(o)	Oct.	103,748,759	11,800						
137	Lansing, Mich., Board of Water & Electric Light Commissioners	137	30,100		29,603		April 11	101,601,476	11,600						
	Total (C)							94,731,240,380							
	Canada														
138	Hydro-Electric Power Commission of Ontario	1	857,950	(M)	847,710		Dec. 12	5,071,853,732	580,000		802,245	(M)			
139	The Shawinigan Water & Power Company*	2		(g)	538,300		Sept. 18	3,726,436,341	426,000		532,945				
140	Duke-Price Power Company, Ltd.	3	351,000		351,000		Sept. 24	2,093,829,000	239,200		321,000				
141	Canadian Hydro-Electric Corporation, Ltd. System	4	395,000		387,000		Oct. 25	2,090,788,460	239,000		286,000				
142	Montreal Light, Heat & Power Consolidated	5	292,020				Nov. 19	1,568,864,226	179,000		279,250				
143	Winnipeg Electric Company (J)	6	125,400		124,200		Jan. 4	703,982,200	80,350		130,500				
144	Canadian Niagara Power Company, Ltd.	7						632,261,900	72,200						
145	West Kootenay Power & Light Company, Ltd.	8			74,800	(n)	Nov. 26	539,626,687	61,500						
146	City of Winnipeg Hydro-Electric System	9	73,400				Dec. 3	445,579,835	50,900		76,290				
147	British Columbia Electric Railway Company, Ltd.	10	(p) 98,900	(c)	94,000	(p)	Nov. 25	418,075,320	47,700	(p)	98,200				
148	Canada Northern Power Corporation, Ltd. System	11	46,420		46,000		Feb. 23	347,797,680	39,600		47,510				
149	Dominion Power & Transmission Company, Ltd.	12	54,200		54,200		Dec.	249,785,300	28,500		52,900				
150	Southern Canada Power Company, Ltd.	13	31,000		31,000		Nov. 27	149,105,920	17,000		31,700				
151	Calgary Power Company, Ltd.	14	29,500				Nov. 25	126,876,336	14,500		26,100				
	Total							18,164,862,937							
	Mexico														
152	The Mexican Light & Power Company, Ltd. and Subsidiaries	1		(o)	111,140	(o)	Dec. 6	641,828,127	73,200		107,608				
153	Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A.	2			22,000		July 21	141,967,487	16,200		24,500				
154	The Guanajuato Power & Electric Company	3		(o)	18,134	(o)	Dec.	107,111,000	12,200						
155	Puebla Tramway, Light & Power Company	4	21,590				June 20	104,808,000	11,900						
	Total							995,714,614							
	Electric Railways and Electrified Railroads														
156	Interborough Rapid Transit Company	1		(a)	304,460	(n)	Dec. 12	1,217,047,463	138,900			(a)			
157	Chicago Surface Lines	2		(o)	200,698	(o)	Feb. 19	(U) 664,908,358	75,900			(o)			
158	Williamsburgh Power Plant Corporation (B.M.T.)	3	(o) 154,100		159,000		Dec. 12	599,442,974	68,400	(o)	146,300				
159	Philadelphia Rapid Transit Company	4			116,162	(n)	Jan. 14	384,076,148	43,800						
160	The Pennsylvania Railroad (Long Island City Gen. Station)	5	(B) 104,000	(o)	89,800	(B)	Jan. 29	343,646,828	39,200	(B)	99,600	(o)			
161	The New York Central Railroad Company	6	(i) 86,500	(m)	75,400		Dec. 23	247,599,220	28,200	(i)	80,000	(c)			
162	Boston Elevated Railway	7	95,755		91,403		Jan. 29	247,473,090	28,200	(Q)	95,937	(Q)			
163	The New York, New Haven & Hartford Railroad Company	8		(o)	41,600			209,370,023	23,900			(c)			
164	Pacific Electric Railway Company	9	55,000		48,000		Jan. 17	182,813,761	20,850		55,000				
165	Chicago, Milwaukee, St. Paul & Pacific Railroad Company	10						156,186,340	17,830						
166	Twin City Rapid Transit Company	11		(o)	49,732			140,190,412	16,000			(o)			
167	Norfolk & Western Railway Company	12			30,000			134,368,264	15,300						
168	Kansas City Public Service Company	13	41,000		38,384		Jan. 10	132,202,720	15,090						
169	The Connecticut Company	14		(b)	16,500			120,427,038	13,700			(b)			
170	The Virginian Railway Company	15	49,000	(c)	35,000		Jan. 21	109,970,000	12,550		44,000	(c)			
	Total							4,889,722,639							

*Because of absorptions and consolidations certain companies separately listed last year have now disappeared. The following list gives the former names and the names of companies in which they are *now included*. Minor changes of name, where the system can be readily indentified, are not listed:

Associated Gas & Electric System (Penna. Elec. Corp. Group). Has been replaced by *Pennsylvania Electric Co.* and *Erie Lighting Co.* which were constituent companies.

Brooklyn Edison Co., Inc.
The New York Edison and Allied Companies.

Buffalo, Niagara & Eastern Power Corp. System.
Mohawk Hudson Power Corp. System
Northern New York Utilities, Inc.
St. Lawrence County Utilities, Inc.
St. Lawrence Valley Power Corp.
Niagara Hudson Power Corp. System.

Delaware Electric Power Co.
Delaware Power & Light Co.

Fort Worth Power & Light Co.
Texas Electric Service Co.

Illinois Power & Light Corp. (Southern Group).
Illinois Power & Light Corp. (Central Group).
Illinois Power & Light Corp. (Illinois).

Michigan Northern Power Co.
Omitted; primarily industrial rather than public utility.

New York-Pennsylvania Power System.
Last year included Binghamton Light, Heat & Power Co. and Northern Pennsylvania Power Co. This year the Binghamton Light, Heat & Power Co. is included in *New York State Electric & Gas Corp.*

Philadelphia Suburban-Counties Gas & Electric Co.
Philadelphia Electric Company System.

Southeastern Power & Light Co. System.
Of this system, the following constituent companies having an output over 100,000,000 kw.-hr. are now listed separately; *Alabama Power Co., Georgia Power Co., Mis. and South Carolina Power Co.*

The Southern Sierras Power Co.
The Nevada-California Electric Corp. System

Turners Falls Power & Electric Co.
United Electric Light Co. (Springfield, Mass
Western Massachusetts Companies System.

The Worcester Electric Light Co.
Fall River Electric Light Co.
New England Power Association System.

Canada

Kaministiquia Power Co., Ltd.
Output in 1928 and 1929 under 100,000,0 to the conditions of the newsprint industry reduction in grain elevator service.

Laurentide Power Co., Ltd.
The Shawinigan Water & Power Co.

(K)	(K)	156,467,174	17,810	31,727	29,500	Dec. 15	135,692,265	28,600	Dec. 21	117,679,234		
		149,811,913	17,060				153,364,676	(c) 33,200	(o) Nov. 17	150,635,115		
36,000		159,666,072	18,180	40,000	36,400		134,416,934	32,000	Nov. 8	128,293,150		
120,600	Feb. 14	222,096,800	25,300	125,540	120,185	Nov. 29	565,609,500	106,400	Nov. 11	439,380,300		
	Sept. 21	152,885,453	17,400	25,340		Jan. 1	114,195,401	(n) 27,620	(n) Dec. 7	100,462,550		
34,750	Oct. 17	151,902,906	17,300	31,570	31,000	Nov. 28	131,017,494	32,530	Sept. 14	124,713,651		
(b) 54,800	Dec. 31	148,932,217	16,950									
(c) 31,790	(o) Nov.	119,647,273	13,600									
	March 13	122,579,000	13,950	24,600		Nov. 20	105,634,000	23,140	Dec. 8	104,648,573		
30,200	Dec. 17	114,835,060	13,070		30,580		116,194,720			107,971,800		
		135,476,900	15,400									
	(A) Dec.	143,646,000	16,340	(A) 30,200		(A) May 19	135,474,100	(c) 28,850		125,911,263	(t)	
23,500	Jan. 4	122,337,055	13,930		(o) 25,000	(o) Dec. 21	109,786,578	22,500	Aug. 13	111,341,210		
28,100	Nov. 26	117,999,180	13,430	29,000	(c) 25,600	Feb. 16	107,715,140	31,500	Feb. 19 and 23	100,957,540		
30,500	Dec. 3	112,097,459	12,760	27,000	27,000	Dec. 16	115,393,187	26,600	Dec. 28	100,874,562		
30,750		108,519,670	12,350									
		104,830,000	11,930									
23,400		93,469,303	10,640		19,000	(n) Oct.	75,389,189					
(M) 794,430	Dec. 20	4,429,404,096	504,000	746,275	(M) 740,530	Dec. 1	4,133,501,842	711,220	Nov. 19	3,867,398,041	6	
532,945	Nov. 13	3,409,717,522	388,000	420,300	420,300	Oct. 18	3,021,201,950	392,330	Dec. 9	2,557,613,443	3	
315,000	Nov. 12	2,096,903,000	238,700				1,719,820,588					
280,000	Dec. 28	1,297,239,606	147,700									
	Nov. 26	1,450,484,998	165,100	256,760	254,000	Dec. 14	1,354,895,244	252,000	Nov. 22	1,251,502,612	2	
129,000	Dec. 4 and 19	654,491,510	74,500	112,000	107,500	Nov. 10	511,103,200	66,200	Dec. 1	285,508,300		
		621,423,800	70,700				604,597,700			591,893,200		
39,700	(n) Oct. 7	516,071,474	58,700		65,600	Aug. 11	476,999,100			410,327,600		
74,940	Dec. 5	400,668,600	45,600	75,834	72,100	Dec. 13	358,371,100	70,844	Dec. 20	324,993,710		
94,600	Dec. 18	390,564,500	44,500	(p) 87,400	(c) 86,600	Dec. 21	350,402,700	79,000	Dec. 16	333,654,900		
45,000	Nov. 17	343,930,010	39,150	43,690	34,850	Dec. 22	305,415,945					
52,900	Nov. 19	232,656,400	26,500	56,300	53,000	Nov. 24	253,859,900	53,200	Dec. 15	241,355,956		
	Oct. 31	146,233,060	16,600		26,300	Nov. 10	125,319,394					
	Dec. 3	104,577,805	11,900									
	Dec. 28	628,832,675	71,600		(c) 102,3 6	(o) Nov.	606,245,844			594,046,265	(n)	
23,600	Dec. 7	160,099,800	18,230	(o) 22,700		(o) Feb. 26	156,086,800			137,149,400		
		100,430,000	11,430									
(a) 298,760	(n) March 6	1,177,155,819	134,000		(a) 284,660	(n) Jan. 27	1,103,063,438		Jan. 28	1,063,717,242	(n)	
(o) 195,730	Dec. 20	(r) 592,545,223	(r) 74,000	300,660		Jan. 3	(r) 577,710,827	264,000	Dec. 14	(r) 581,706,072	(i)	
150,000	Feb. 6	568,889,703	64,800	(o) 138,200	142,000	Dec. 9	544,081,653	(o) 138,100	Jan. 29	542,141,625	(o)	
110,071	(n) Dec. 21	377,326,475	42,950		120,318	(n) Jan. 11	371,731,556		Jan. 28	390,915,742	(n)	
(o) 87,700	(B) Dec. 8	333,037,210	37,900	(B) 99,600	(o) 87,000	(B) Dec. 9	307,432,390	(B) 88,800		286,533,764		
(c) 68,280	(o) Jan. 3	230,003,185	26,200	(i) 75,000	(c) 60,360		222,131,354	73,000	Dec. 27	205,649,608	(i)	
(Q) 91,576	March 9	(Q) 252,965,140	(Q) 28,800	(Q) 94,457	(Q) 90,164	Jan. 26	(Q) 243,925,965	94,490	Jan. 29	257,696,595		
(c) 40,750		201,191,225	22,900	50,500	40,900	Nov. 23	189,691,700	(G) 43,000	Dec. 16	209,658,870		
48,000	Aug. 15	184,759,206	21,030	54,000	47,000	April 6	190,485,000	52,000	Dec. 22	187,975,148	(o)	
		(T) 162,274,409	(T) 18,500				(T) 148,560,111			(T) 138,083,293		
(o) 46,865		135,530,869	15,430		(o) 45,333	Dec. 6	137,695,684		(n) Jan. 19	140,216,985	(n)	
30,000		127,944,156	14,570				123,759,732	38,500	Oct. 30	106,426,752		
		132,306,100	15,060	44,000	41,000	Jan. 14	128,913,861	45,000	Dec. 15	131,186,730		
(b) 18,500		109,993,477	12,500		(b) 26,925		114,168,609		(o) Feb. 10	115,769,700		
(c) 36,000	Jan. 20	104,636,000	11,900									

Mississippi Power Co.

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(a) Actual over thirty-minute period.
(b) Actual over one-hour period.
(c) Estimated over one-hour period.
(d) Includes 12,500 kw. joint operation with Commonwealth Edison Co.
(e) Capacity of major generating plants 74,265 kw.
(f) Includes 24,239,872 kw.-hr. joint operation with Commonwealth Edison Co.
(g) Over ten-minute period. Electric only. Does not include 41,000 kw. hydraulic. (See Table II.)
(h) Estimated over fifteen-minute period. (i) Estimated.
(k) Kva. (l) For Texas Division. (m) Over fifteen-minute period. (n) Over thirty-minute period. (o) Over one-hour period. (p) Estimated over ten-minute period. (q) Over eight-hour period.
(r) Output measured on d.c. side, average load on a.c. side.
(s) On same method of accounting for energy transferred between districts as in 1927, output in 1926 would be 225,812,630 kw.-hr.
(t) Over five-minute period, 25-cycle system 12,500 kw.; 60-cycle system 17,800 kw.
(u) 25-cycle system Dec. 2; 60-cycle system Dec. 9.
(A) Duration of peak not specified.
(B) Over five-minute period.
(C) Canadian Niagara Power Co. Ltd. (See Canada) included in Niagara-Hudson Power Corp. System. Latter comprises systems of Buffalo, Niagara & Eastern Power Corp., Mohawk-Hudson Power Corp., Northeastern Power Corp., St. Lawrence Securities Co., St. Lawrence Power Co., Ltd. (Canada), Fulton Light, Heat & Power Co. and Peoples Gas & Electric Co. of Oswego.
(D) Includes 11,000 kw. joint operation with Commonwealth Edison Co.
(E) Includes 50,961,607 k
monwealth Edison Co
(F) Includes Philadelphia
Electric Co. and Susque
Suburban-Counties Ga
(G) On generating plant o
(H) Includes 1929 and 192
Edison Co., Inc., Nev
Power Co., United
Yonkers Electric Lig
cluded Westchester L
Lighting Co., Peekskil
Gas & Electric Co. h
(see also Supplement
(I) Covers the period July
(K) Includes Manitoba P
(J) Peak included in Illin
(L) Not comparable with
(M) Over twenty-minute p

5,000	(b) Dec.											
.....	Dec. 20	180,016,985	20,500	45,000	40,000	Dec. 17	152,957,600	17,400	34,000	34,000	Nov. 30	
89,400	Dec. 12	177,338,443	20,200	(K)	(K)	(K)	156,467,174	17,810	31,727	29,500	Dec. 15	
.....	Nov. 26	176,194,115	20,100	.....	.....	.....	149,811,913	17,060	.....	.....	.....	
42,500	(n) Nov. 12	172,539,101	19,700	.....	36,000	.....	159,666,072	18,180	40,000	36,400	.....	
12,500	Aug. 24	171,681,600	19,500	130,000	120,600	Feb. 14	222,096,800	25,300	125,540	120,185	Nov. 29	
83,000	Dec. 17	170,887,397	19,400	31,720	.....	Sept. 21	152,885,453	17,400	25,340	.....	Jan. 1	
40,000	Dec. 11	164,206,522	18,700	35,030	34,750	Oct. 17	151,902,906	17,300	31,570	31,000	Nov. 28	
40,500	Dec.	162,477,080	18,500	.....	.....	.....	.....	.....	.....	.....	.....	
53,200	Sept. 12	162,129,679	18,500	(i) 60,000	(b) 54,800	Dec. 31	148,932,217	16,950	.....	.....	.....	
.....	.....	149,696,794	17,000	.....	(c) 31,790	(o) Nov.	119,647,273	13,600	.....	.....	.....	
.....	May 2	145,405,000	16,600	26,480	.....	March 13	122,579,000	13,950	24,600	.....	Nov. 20	
41,940	Dec. 10	144,364,260	16,400	31,380	30,200	Dec. 17	114,835,060	13,070	.....	30,580	.....	
.....	.....	143,058,177	16,300	.....	.....	.....	135,476,900	15,400	.....	.....	.....	
31,800	(o) Dec.	140,850,741	16,080	(A) 32,060	.....	(A) Dec.	143,646,000	16,340	(A) 30,200	.....	(A) May 19	
29,440	.....	136,213,088	15,500	.....	.....	.....	.....	.....	.....	.....	.....	
29,700	Dec. 11	134,571,700	15,360	24,500	23,500	Jan. 4	122,337,055	13,930	.....	(o) 25,000	(o) Dec. 21	
31,800	Nov. 13	128,665,860	14,650	32,600	28,100	Nov. 26	117,999,180	13,430	29,000	(c) 25,600	Feb. 16	
29,400	Dec. 5	127,820,205	14,500	30,500	30,500	Dec. 3	112,097,459	12,760	27,000	27,000	Dec. 16	
.....	.....	126,624,123	14,400	.....	.....	.....	.....	.....	.....	.....	.....	
27,800	(n) Oct. 23	122,992,015	14,000	.....	30,750	.....	108,519,670	12,350	.....	.....	.....	
.....	.....	119,716,000	13,660	.....	.....	.....	104,830,000	11,930	.....	.....	.....	
30,300	.....	116,745,731	13,300	.....	23,400	.....	93,469,303	10,640	.....	19,000	(n) Oct.	
26,810	Dec. 17	115,530,335	13,200	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	112,617,618	12,860	.....	.....	.....	.....	.....	.....	.....	.....	
23,065	(o) Dec.	111,870,280	12,700	.....	.....	.....	.....	.....	.....	.....	.....	
23,230	(n) Dec. 7	103,802,181	11,850	.....	.....	.....	.....	.....	.....	.....	.....	
25,508	(o) Oct.	103,748,759	11,800	.....	.....	.....	.....	.....	.....	.....	.....	
29,603	April 11	101,601,476	11,600	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	94,731,240,380	.....	.....	.....	.....	.....	.....	.....	.....	.....	
47,710	Dec. 12	5,071,853,732	580,000	802,245	(M) 794,430	Dec. 20	4,429,404,096	504,000	746,275	(M) 740,530	Dec. 1	4,
38,300	Sept. 18	3,726,436,341	426,000	532,945	532,945	Nov. 13	3,409,717,522	388,000	420,300	420,300	Oct. 18	3,
51,000	Sept. 24	2,093,829,000	239,200	321,000	315,000	Nov. 12	2,096,903,000	238,700	.....	.....	.....	1,
87,000	Oct. 25	2,090,788,460	239,000	286,000	280,000	Dec. 28	1,297,239,606	147,700	.....	.....	.....	
.....	Nov. 19	1,568,864,226	179,000	279,250	.....	Nov. 26	1,450,484,998	165,100	256,760	254,000	Dec. 14	1,
24,200	Jan. 4	703,982,200	80,350	130,500	129,000	Dec. 4 and 19	654,491,510	74,500	112,000	107,500	Nov. 10	
.....	.....	632,261,900	72,200	.....	.....	.....	621,423,800	70,700	.....	.....	.....	
74,800	(n) Nov. 26	539,626,687	61,500	.....	39,700	(n) Oct. 7	516,071,474	58,700	.....	65,600	Aug. 11	
.....	Dec. 3	445,579,835	50,900	76,290	74,940	Dec. 5	400,668,600	45,600	75,834	72,100	Dec. 13	
94,000	(p) Nov. 25	418,075,320	47,700	(p) 98,200	94,600	Dec. 18	390,564,500	44,500	(p) 87,400	(c) 86,600	Dec. 21	
46,000	Feb. 23	347,797,680	39,600	47,510	45,000	Nov. 17	343,930,010	39,150	43,690	34,850	Dec. 22	
54,200	Dec.	249,785,300	28,500	52,900	52,900	Nov. 19	232,656,400	26,500	56,300	53,000	Nov. 24	
31,000	Nov. 27	149,105,920	17,000	31,700	.....	Oct. 31	146,233,060	16,600	.....	26,300	Nov. 10	
.....	Nov. 25	126,876,336	14,500	26,100	.....	Dec. 3	104,577,805	11,900	.....	.....	.....	
.....	.....	18,164,862,937	.....	.....	.....	.....	.....	.....	.....	.....	.....	
111,140	(o) Dec. 6	641,828,127	73,200	107,608	.....	Dec. 28	628,832,675	71,600	.....	(c) 102,3 6	(o) Nov.	
22,000	July 21	141,967,487	16,200	24,500	23,600	Dec. 7	160,099,800	18,230	(o) 22,700	.....	(o) Feb. 26	
18,134	(o) Dec.	107,111,000	12,200	.....	.....	.....	100,430,000	11,430	.....	.....	.....	
.....	June 20	104,808,000	11,900	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	995,714,614	.....	.....	.....	.....	.....	.....	.....	.....	.....	
304,460	(n) Dec. 12	1,217,047,463	138,900	.....	(a) 298,760	(n) March 6	1,177,155,819	134,000	.....	(a) 284,660	(n) Jan. 27	1,
200,698	(o) Feb. 19	(U) 664,908,358	75,900	.....	(o) 195,730	Dec. 20	(r) 592,545,223	(r) 74,000	300,660	.....	Jan. 3	(r)
159,000	Dec. 12	599,442,974	68,400	(o) 146,300	150,000	Feb. 6	568,889,703	64,800	(o) 138,200	142,000	Dec. 9	
116,162	(n) Jan. 14	384,076,148	43,800	.....	110,071	(n) Dec. 21	377,326,475	42,950	.....	120,318	(n) Jan. 11	
89,800	(B) Jan. 29	343,646,828	39,200	(B) 99,600	(o) 87,700	(B) Dec. 8	333,037,210	37,900	(B) 99,600	(o) 87,000	(B) Dec. 9	
75,400	Dec. 23	247,599,220	28,200	(i) 80,000	(c) 68,280	(o) Jan. 3	230,003,185	26,200	(i) 75,000	(c) 60,360	.....	
91,403	Jan. 29	247,473,090	28,200	(Q) 95,937	(Q) 91,576	March 9	(Q) 252,965,140	(Q) 28,800	(Q) 94,457	(Q) 90,164	Jan. 26	(Q)
41,600	.....	209,370,023	23,900	.....	(c) 40,750	.....	201,191,225	22,900	50,500	40,900	Nov. 23	
48,000	Jan. 17	182,813,761	20,850	55,000	48,000	Aug. 15	184,759,206	21,030	54,000	47,000	April 6	
.....	.....	156,186,340	17,830	.....	.....	.....	(T) 162,274,409	(T) 18,500	.....	.....	.....	(T)
49,732	.....	140,190,412	16,000	.....	(o) 46,865	.....	135,530,869	15,430	.....	(o) 45,333	Dec. 6	
30,000	.....	134,368,264	15,300	.....	30,000	.....	127,944,156	14,570	.....	.....	.....	
38,384	Jan. 10	132,202,720	15,090	.....	.....	.....	132,306,100	15,060	44,000	41,000	Jan. 14	
16,500	.....	120,427,038	13,700	.....	(b) 18,500	.....	109,993,477	12,500	.....	(b) 26,925	.....	
35,000	Jan. 21	109,970,000	12,550	44,000	(c) 36,000	Jan. 20	104,636,000	11,900	.....	.....	.....	
.....	.....	4,889,722,639	.....	.....	.....	.....	.....	.....	.....	.....	.....	

outhern Group).
entral Group).
Illinois).

rather than public utility.

System.
ton Light, Heat & Power Co.
Power Co. This year the Bing-
r Co. is included in *New York*

Gas & Electric Co.
System.
. System.
constituent companies having
-hr. are now listed separately;

Alabama Power Co., Georgia Power Co., Mississippi Power Co. and South Carolina Power Co.

The Southern Sierras Power Co.
The Nevada-California Electric Corp. System.

Turners Falls Power & Electric Co.

United Electric Light Co. (Springfield, Mass).
Western Massachusetts Companies System.

The Worcester Electric Light Co.

Fall River Electric Light Co.
New England Power Association System.

Canada

Kaministiquia Power Co., Ltd.
Output in 1928 and 1929 under 100,000,000 kw.-hr. owing to the conditions of the newsprint industry and considerable reduction in grain elevator service.

Laurentide Power Co., Ltd.
The Shawinigan Water & Power Co.

(a) Actual over thirty-minute period.
(b) Actual over one-hour period.
(c) Estimated over one-hour period.
(d) Includes 12,500 kw. joint operation with Commonwealth Edison Co.
(e) Capacity of major generating plants 74,265 kw.
(f) Includes 24,239,872 kw.-hr. joint operation with Commonwealth Edison Co.
(g) Over ten-minute period. Electric only. Does not include 41,000 kw. hydraulic. (See Table II.)
(h) Estimated over fifteen-minute period. (i) Estimated.
(k) Kva. (l) For Texas Division. (m) Over fifteen-minute period. (n) Over thirty-minute period. (o) Over one-hour period. (p) Estimated over ten-minute period. (q) Over eight-hour period.
(r) Output measured on d.c. side, average load on a.c. side.
(s) On same method
tween districts
225,812,630 kw.-
(t) Over five-minute
60-cycle system
(u) 25-cycle system
(A) Duration of peak
(B) Over five-minute
(C) Canadian Niagar
in Niagara-Huds
prises systems of
Mohawk-Hudson
St. Lawrence Sec
(Canada), Fulto
Gas & Electric C
(D) Includes 11,000
Edison Co.

135,692,265	28,600	Dec. 21	117,679,234	25,800	Sept. 30	106,992,465					111
153,364,676	(c) 33,200	(o) Nov. 17	150,635,115	30,400	Dec. 4	128,835,193	35,000	Dec.	113,239,516		112
134,416,934	32,000	Nov. 8	128,293,150								113
565,609,500	106,400	Nov. 11	439,380,300								114
114,195,401	(n) 27,620	(n) Dec. 7	100,462,550								115
131,017,494	32,530	Sept. 14	124,713,651	30,000	Dec. 4	108,316,069					116
											117
											118
											119
105,634,000	23,140	Dec. 8	104,648,573								120
116,194,720			107,971,800								121
											122
135,474,100	(c) 28,850		125,911,263	(t) 30,300	(u)	118,617,000	(B) 26,400	Dec. 10	107,440,900		123
											124
109,786,578	22,500	Aug. 13	111,341,210								125
107,715,140	31,500	Feb. 19 and 23	100,957,540								126
115,393,187	26,600	Dec. 28	100,874,562								127
											128
											129
											130
75,389,189											131
											132
											133
											134
											135
											136
											137
4,133,501,842	711,220	Nov. 19	3,867,398,041	635,485	Dec. 8	3,298,347,874	576,403	Dec. 22	3,026,615,156		138
3,021,201,950	392,330	Dec. 9	2,557,613,443	371,002	Nov. 24	2,421,046,311	347,448	Nov. 7	2,066,066,762		139
1,719,820,588											140
											141
1,354,895,244	252,000	Nov. 22	1,251,502,612	233,230	Dec. 9	1,175,430,654	221,060	Dec. 24	1,157,648,660		142
511,103,200	66,200	Dec. 1	285,508,300	61,100	Jan.	252,891,600					143
604,597,700			591,893,200								144
476,999,100			410,327,600								145
358,371,100	70,844	Dec. 20	324,993,710	60,321	Dec. 31	261,996,380	46,065	Oct. 28	200,520,080		146
350,402,700	79,000	Dec. 16	333,654,900	83,100	Dec. 22	336,907,650	75,200	Dec. 9	300,456,350		147
305,415,945											148
253,859,900	53,200	Dec. 15	241,355,956								149
125,319,394											150
											151
606,245,844			594,046,265	(n) 98,991		561,425,403					152
156,086,800			137,149,400			112,261,000					153
											154
											155
1,103,063,438		Jan. 28	1,063,717,242	(n) 276,380	Jan. 23	1,063,504,660	(n) 272,760	Jan. 26	1,019,620,637		156
(r) 577,710,827	264,000	Dec. 14	(r) 581,706,072	(i) 200,000	Feb. 27	630,560,494	(o) 185,866	Dec. 23	604,581,618		157
544,081,653	(o) 138,100	Jan. 29	542,141,625	(o) 132,300	Dec. 23	508,481,425	(o) 132,200	Dec. 26	478,911,990		158
371,731,556		Jan. 28	390,915,742	(n) 116,160	Jan. 28	385,707,158	(n) 120,885	Jan. 21	371,519,687		159
307,432,390	(B) 88,800		286,533,764	98,000	Jan. 2	266,137,403	96,300	Dec. 26	244,345,733		160
222,131,354	73,000	Dec. 27	205,649,608	(i) 70,000	Dec. 28	184,775,459	62,500	Dec. 24	173,938,625		161
(Q) 243,925,965	94,490	Jan. 29	257,696,595	94,226	Jan. 28	247,490,105	94,869	Jan. 21	261,091,060		162
189,691,700	(G) 43,000	Dec. 16	209,658,870	40,000	Dec. 10	209,542,400					163
190,485,000	52,000	Dec. 22	187,975,148	(o) 44,000	Dec. 15	183,000,000	50,000	April 3	185,000,000		164
(T) 148,560,111			(T) 138,083,293			136,993,694			(i) 116,974,186		165
137,695,684		(n) Jan. 19	140,216,985	(n) 24,460		144,413,357			143,000,000		166
123,759,732	38,500	Oct. 30	106,426,752								167
128,913,861	45,000	Dec. 15	131,186,730	43,000	Jan. 27-Dec. 22	127,740,470	43,000	Dec. 18	129,383,860		168
114,168,609		(o) Feb. 10	115,769,700								169
											170

ethod of accounting for energy transferred be-
icts as in 1927, output in 1926 would be
kw.-hr.

inute period, 25-cycle system 12,500 kw.;
tem 17,800 kw.

tem Dec. 2; 60-cycle system Dec. 9.

peak not specified.

inute period.

iagara Power Co. Ltd. (See Canada) included Hudson Power Corp. System. Latter comns of Buffalo, Niagara & Eastern Power Corp., udson Power Corp., Northeastern Power Corp., e Securities Co., St. Lawrence Power Co., Ltd. Fulton Light, Heat & Power Co. and Peoples tric Co. of Oswego.

,000 kw. joint operation with Commonwealth

(E) Includes 50,961,607 kw.-hr. joint generation with Commonwealth Edison Co.

(F) Includes Philadelphia Electric Co., Delaware County Electric Co. and Susquehanna Electric Co.; also Philadelphia Suburban-Counties Gas & Electric Co. in 1929.

(G) On generating plant only.

(H) Includes 1929 and 1928, New York Edison Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co., United Electric Light & Power Co. and Yonkers Electric Light & Power Co. In 1927 also included Westchester Lighting Co., Northern Westchester Lighting Co., Peekskill Lighting & Railroad Co. and Bronx Gas & Electric Co. but not Brooklyn Edison Co., Inc. (see also Supplement of April 30, 1927).

(I) Covers the period July 1 to December 31.

(K) Includes Manitoba Power Co., Ltd.

(J) Peak included in Illinois Electric Power Co.

(L) Not comparable with previous years because of merger.

(M) Over twenty-minute period.

(N) 25-cycle, 18,300 instantaneous, 18,000 half-hour May 11; 60-cycle, 49,000 instantaneous, 48,500 half-hour Dec. 19.

(O) Operations for 1929, 1928 and 1927 include Bridgeport and New Haven divisions; 1926 figures for Bridgeport division only.

(P) Includes Metropolitan Edison Co., New Jersey Power & Light Co., Fleetwood & Kutztown Electric Light, Heat & Power Co. and Maryland Public Service Co.; in 1929 also includes Bangor (Pa.) Electric Co.

(Q) Converted a.c. measured on d.c. side; plus generated d.c.

(R) Includes the properties formerly known as Binghamton Light, Heat & Power Co. and Lockport Light, Heat & Power Co.

(S) Includes The Southern Sierras Power Co., Nevada-California Power Co. and Yuma Utilities Co. (prior to 1926, Desert Water, Oil & Irrigation Co.).

(T) Energy consumed.

(U) A.-c. input.

Table II—Detailed Data on Ge of All Systems Having

Line No.	Section and System	Generator Rating, Dec. 31, 1929				Generated and Purchased Output, 1929			
		Fuel Burning Plants		Hydro Plants					
		No. of Plants	Rating of Generators, Kw.	No. of Plants	Rating of Generators, Kw.	Total Output, Kw.-Hr.	Generated (Net) Kw.-Hr.	Purchased, Kw.-Hr.	Resid Ser
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(
	New England States								
1	New England Power Association System	8	355,100	11	171,300	1,703,536,819	1,354,453,510	349,083,309	10
2	The Edison Electric Illuminating Company of Boston	3	375,860	1	50	1,041,388,668	992,446,066	48,942,602	12
3	The Connecticut Light & Power Company	3	109,100	6	53,870	580,426,439	532,057,149	48,369,290	4
4	Western Massachusetts Companies System	3	94,350	6	66,985	494,805,982	329,717,260	165,088,722	3
5	The Hartford Electric Light Company	2	(o) 126,000	1	1,500	362,855,320	248,387,050	(p) 114,468,270	2
6	Montaup Electric Company	1	73,000	0	0	338,215,600	338,215,600	0	
7	United Illuminating Company	3	134,500	0	0	(c) 288,417,200	(c) 288,417,200	0	(
8	Central Maine Power Company	2	13,500	23	61,770	270,606,693	239,468,358	31,138,335	(E) 1
9	New Bedford Gas & Edison Light Company	1	92,000	0	0	219,020,744	219,020,744	0	(d) 1
10	Blackstone Valley Gas & Electric Company	1	33,500	3	1,750	207,701,144	24,341,219	183,359,925	1
11	Cumberland County Power & Light Company	1	22,500	5	22,500	144,364,260	139,663,960	4,700,300	1
12	Salem Electric Lighting Company	1	27,500	0	0	(c) 127,820,205	(c) 127,781,650	38,555	
	Totals for section	29	1,456,910	56	379,725	5,779,159,074	4,833,969,766	945,189,308	
	Middle Atlantic States								
13	Niagara Hudson Power Corporation System (t)	9	386,546	83	944,445	7,212,743,072	6,171,107,190	1,041,635,882	30
14	The New York Edison and Allied Companies (u)	8	1,930,500	0	0	4,678,700,000	4,678,700,000	0	(v) 3,20
15	Philadelphia Electric Company System	9	675,450	2	252,165	3,029,885,631	2,986,777,500	43,108,131	23
16	Public Service Electric & Gas Company (N. J.)	5	556,450	0	0	2,134,581,298	1,802,207,845	332,373,453	25
17	The West Penn Electric Company Subsidiaries	26	457,374	9	55,595	1,938,955,818	1,904,547,998	34,407,820	11
18	Duquesne Light Company	3	384,000	0	0	1,573,445,327	1,560,187,937	13,257,390	18
19	Pennsylvania Power & Light Company	18	294,862	14	43,472	1,251,104,868	790,945,098	460,159,770	9
20	Pennsylvania-New Jersey Power System (w)	5	173,000	7	19,728	735,612,022	692,857,096	42,754,926	4
21	Pennsylvania Water & Power Company	1	20,000	1	111,000	610,962,200	610,962,200	0	
22	Rochester Gas & Electric Corporation	5	76,975	9	47,870	393,506,327	362,373,824	31,132,503	5
23	New York State Electric & Gas Corporation (x)	13	66,590	22	14,872	377,746,958	210,297,091	167,449,867	4
24	Pennsylvania Electric Company	6	49,675	0	0	364,412,911	197,445,863	166,967,048	3
25	The Scranton Electric Company	4	123,500	0	0	240,508,000	238,395,000	2,113,000	2
26	Penn Central Light & Power Company	4	76,100	3	4,420	237,817,248	234,863,383	2,953,865	2
27	Westchester Lighting Company	1	8,600	0	0	216,503,601	0 (y)	216,503,601	(e) 11
28	Central Hudson Gas & Electric Corporation	3	17,900	6	25,925	200,566,867	82,000,300	118,566,567	1
29	Long Island Lighting Company and Subsidiaries	6	93,100	0	0	197,097,106	197,089,076	8,030	(z) 14
30	Atlantic City Electric Company	2	58,000	0	0	184,172,000	151,380,000	32,792,000	2
31	Edison Electric Company of Lancaster, Pa.	1	7,000	2	300	140,850,741	0	140,850,741	1
32	Staten Island Edison Corporation	1	47,500	0	0	128,665,860	128,399,460	266,400	1
33	Erie Lighting Company	2	39,500	0	0	126,624,123	123,678,248	2,945,875	
34	Luzerne County Gas & Electric Corporation	2	55,000	0	0	115,530,335	123,821,989	(A) —8,291,654	1
	Totals for section (t)	134	5,597,622	158	1,519,792	26,089,992,313	23,248,037,098	2,841,955,215	
	East North Central States								
35	Commonwealth Edison Company	5	1,090,500	0	0	4,636,434,000	3,826,748,000	809,686,000	48
36	The Detroit Edison Company	4	813,000	7	9,160	2,654,901,300	2,651,711,300	3,190,000	(Q) 30
37	The Ohio Power Company	15	395,345	4	2,850	1,544,252,000	1,374,674,000	169,578,000	6
38	The Cleveland Electric Illuminating Company	4	447,000	0	0	1,447,193,594	1,446,625,594	568,000	16
39	The North American Co. System (Wis.-Michigan Group)	11	361,884	9	15,793	1,311,738,004	1,171,854,664	139,883,340	(d) 27
40	Public Service Company of Northern Illinois	15	(B) 246,275	3	4,100	1,246,330,283	694,706,651	551,623,632	11
41	Columbia Gas & Electric Corporation System	9	401,050	0	0	1,203,652,405	1,203,613,505	38,900	13
42	Consumers Power Company	10	236,200	33	109,105	1,198,947,711	1,037,419,147	161,528,564	12
43	The Pennsylvania-Ohio Power & Light Company	3	212,000	0	0	634,346,780	623,578,420	10,768,360	3
44	The Ohio Public Service Company	8	130,100	0	0	611,482,217	438,356,966	173,125,251	3
45	Illinois Power & Light Corporation (Illinois)	20	100,605	1	3,590	542,629,220	125,349,242	417,279,978	5
46	Indiana & Michigan Electric Company	2	94,000	4	22,004	538,734,000	519,128,000	19,606,000	2
47	The Toledo Edison Company	4	160,200	2	6,800	514,989,108	397,053,946	117,935,162	4
48	State Line Generating Company	1	200,000	0	0	(C) 430,779,000	430,779,000	0	
49	Central Indiana Power Company Subsidiaries	11	92,285	1	384	424,300,963	313,604,913	110,696,050	1
50	Indianapolis Power & Light Company	3	103,200	0	0	388,871,320	352,790,850	36,080,470	4
51	Northern Ohio Power & Light Company	1	67,000	1	2,175	384,412,400	195,232,810	189,179,590	4
52	Central Illinois Public Service Company	8	84,225	0	0	367,912,947	235,788,558	132,124,389	3
53	Northern Indiana Public Service Company	2	33,600	5	515	334,913,629	106,991,741	227,921,888	2
54	The Columbus Railway, Power & Light Company	3	144,000	0	0	315,558,310	315,890,600	—332,290	4
55	Interstate Public Service Company	11	48,927	5	5,430	303,769,447	152,704,970	151,064,477	2
56	Wisconsin Power & Light Company	8	25,300	37	39,185	296,527,833	233,648,779	62,879,054	2
57	Illinois Electric Power Company	2	83,000	0	0	246,321,037	242,753,637	3,567,400	
	[illegible] Division of Light & Power	1	50,000	0	0	198,179,340	198,179,340	0	2

Supplement to ELECTRICAL WORLD, May 3, 1930

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Generator Rating, Output, Customers and Distribution of
ng an Output Over 100,000,000 Kw.-Hr. During 1929

Distribution of Output in Kilowatt-Hours, 1929									Number of			
Residential Service (10)	Commercial Light and Small Power (11)	Wholesale Energy (12)	Municipal Service (See Note *a*) (13)	Other Sales (Heating, etc.) (14)	Electrical Railway Operation (See Note *b*) (15)	Sold to Other Public Utilities (See Note *a*) (16)	Intra-Company Business (See Note *b*) (17)	Not Accounted for (Losses) (18)	Residential (19)	Commercial Light and Small Power (20)	Wholes (21)
101,567,123	93,291,002	636,525,329	32,577,007	.....	103,848,418	474,474,138	12,174,113	249,079,699	278,080	39,107	9,
125,992,850	182,493,292	305,250,482	27,218,947	.....	7,942,207	228,752,696	3,084,234	160,653,960 (*m*)	281,497 (*m*)	69,923 (*m*)	
46,288,263	29,255,150	261,306,985	6,952,826	.....	52,922,404	93,373,343	9,055,522	81,271,946	96,068	14,257	2,
30,720,380	25,121,169	228,214,653	9,471,617	(*n*) 18,288,329	32,120,387	74,251,588	7,135,992	69,481,867	71,052	11,502	2,
29,001,353	59,119,725	64,209,853	6,187,020	.....	26,908,000	124,506,894	(*q*) 18,471,200	34,451,275	58,243	10,206	
0	0	0	0	0	0	338,215,600	0	(*r*)	0	0	
(*e*)	(*e*)	(*e*) 248,348,354	.....	.....	0	4,323,700	.....	35,745,146	100,819	(*k*)	(*k*) 18,
16,453,870	14,804,600	142,950,638	7,260,950	8,270,927	9,374,650	8,822,362	14,660,331	48,008,365	(*E*) 55,738	9,602	1,
17,631,696	(*d*)	156,975,802	2,796,467	.....	.....	20,867,948	2,038,070	18,710,761	(*g*) 34,008 (*g*)	6,700 (*g*)	
12,425,191	13,969,916	131,561,052	3,311,839	.....	.....	19,777,772	523,120	26,132,254	40,173	5,763	
14,184,929	17,007,276	36,602,204	4,491,434	1,262,213	17,218,303	30,395,480	912,721	22,289,700	33,480	6,422	1,
3,122,753	3,059,499	23,187,751	1,073,080	91,196	5,650,100	83,976,350	(*s*) 4,321,636	3,337,840	9,324	2,012	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
308,736,211	481,632,171	4,764,518,112	141,244,510	.....	258,983,173	544,215,014	24,969,486	688,444,395	546,278	90,029	3,
3,207,600,000	(*v*)	(*v*)	158,700,000	(*v*)	307,900,000	238,800,000	(*i*)	(*i*) 765,700,000	(*f*, *h*) 2,143,431	(*h*)	(*h*)
239,871,581	229,058,815	1,137,161,806	56,473,289	.....	487,110,935	500,558,155	22,803,428	356,847,622	(*f*) 501,283 (*f*)	91,504 (*f*)	30,
254,787,165	269,796,988	1,009,026,506	60,555,099	.....	203,356,617	16,194,480	14,615,972	306,248,471	(*f*, *d*) 847,068	(*d*) (*f*)	39,
110,242,688	97,801,099	1,350,021,274	33,602,802	.....	84,892,112	23,041,342	(*i*)	(*i*) 239,354,501	218,942	40,353	6,
181,243,109	121,619,905	824,447,973	31,954,035	.....	223,884,261	629,432	6,993,118	182,673,494	269,552	32,714	1,
92,660,130	78,272,059	757,868,943	33,501,320	.....	.....	119,146,529	.....	169,655,887	235,647	40,194	7,
42,880,170	36,773,400	383,014,425	9,333,692	.....	30,010,096	106,254,250	7,131,320	120,214,669	111,447	22,096	3,
0	0	0	0	0	0	564,557,600	0	46,404,600	0	0	
52,075,824 (*k*)	197,633,647	(*k*)	18,650,992	.....	45,210,072	13,059,472	15,350,627	51,525,542	104,214 (*k*)	11,889	(*k*)
49,555,159	106,864,062	72,968,113	13,439,097	.....	7,920,714	69,578,122	12,651,775	44,769,916	115,147	21,420	
30,779,713	46,855,832	193,457,512	3,854,075	.....	3,825,010	10,056,323	4,643,039	70,941,407	71,639	13,502	
22,357,000	26,689,000	132,228,000	(*j*)	(*j*) 5,380,000	24,000,000	1,831,000	.....	28,023,000	61,743	9,693	
23,094,390	12,816,101	121,913,324	5,035,219	.....	15,850,558	21,994,314	2,203,902	34,909,440	48,432	6,360	1,
115,211,191	(*e*)	(*e*)	15,485,965	2,500,221	1,201,000	1,509,326	43,129,862	37,466,036 (*h*)	133,345	(*h*)	(*h*)
17,645,665	26,420,178	53,898,536	10,233,729	358,758	2,319,192	55,485,253	5,437,648	28,767,908	45,922	12,373	
143,234,728	(*z*)	(*z*)	(*z*)	.....	0	2,932	5,973,694	47,885,752 (*h*)	128,955	(*h*)	(*h*)
28,134,000	27,269,000	69,608,000	(*j*)	(*j*) 19,202,000	1,326,000	1,008,000	.....	37,625,000	71,564	12,066	
14,925,129	15,840,425	77,640,703	9,292,231	.....	.....	2,533,547	.....	20,618,706	37,851	4,886	3
13,350,678	7,460,222	56,977,635	8,242,720	.....	26,198,088	3,311,200	861,283	12,264,034	33,588	4,876	
6,633,567	10,971,508	46,979,806	274,227	.....	6,795,844	.....	39,838,720	15,130,451	14,810	2,135	
10,803,764	5,541,587	82,714,607	2,730,168	.....	1,306,149	688,350	1,154,117	10,591,593	29,725	3,171	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
483,645,000	552,449,000	1,695,943,000	124,689,000	219,000	964,749,000	360,253,000	19,896,000	434,591,000	816,243	131,266	3
305,349,876	537,709,658	1,124,678,978	63,010,138	.....	137,432,900	119,754,990	36,734,800	330,229,900 (*Q*)	483,716	85,378	
68,669,000	106,727,000	624,380,000	(*j*)	(*j*) 26,223,000	5,302,000	603,351,000	.....	109,600,000	160,356	31,442	
168,045,953	121,688,930	736,829,167	19,782,316	4,988,319	132,095,770	96,520,686	4,832,556	162,409,897	272,282	34,920	
277,995,781	(*d*)	643,193,029	13,589,108	.....	3,862,908	57,595,152	137,677,121	177,824,905 (*d*)	281,203	(*d*)	1
113,068,095	90,524,843	348,480,732	61,603,461	6,751,673	86,305,970	349,824,131	11,292,095	178,479,283	234,473	41,709	
131,387,973	105,856,162	555,578,430	40,569,925	.....	124,534,925	83,745,672	29,242,374	132,736,944	269,023	36,132	
125,663,999	110,848,829	649,651,691	17,847,908	.....	56,458,629	19,071,260	10,959,383	208,446,012	250,106	36,268	
30,075,526	27,634,333	200,624,831	8,900,491	.....	29,624,666	280,455,321	1,227,703	55,803,909	53,205	7,119	
38,416,769	43,086,911	388,142,414	6,834,085	.....	4,527,274	71,264,355	2,079,294	57,130,515	69,039	12,046	
52,564,350	49,022,547	249,418,154	16,330,576	(*l*) 1,576,345	56,026,497	4,983,283	5,020,029	107,687,439	152,120	27,165	
25,180,000	36,349,000	88,544,000	(*j*)	(*j*) 5,215,000	14,031,000	315,476,000	.....	53,939,000	54,376	8,733	
44,966,150	48,211,047	260,125,473	8,427,542	.....	36,818,154	39,897,697	3,809,244	72,733,801	86,723	10,004	
0	0	0	0	0	0	430,799,000	0	0	0	0	
14,356,975	13,170,547	159,738,031	4,228,919	(*l*) 2,212,866	3,594,560	165,686,189	1,484,022	59,768,854	42,106	8,914	
40,037,255	89,466,724	150,008,092	16,734,937	(*l*) 6,513,193	.....	10,539,572	13,508,190	62,063,357	87,384	12,488	
46,026,334	33,093,255	191,626,930	20,143,750	.....	38,055,555	7,616,080	1,729,937	46,120,559	72,621	9,015	
39,780,102	52,450,784	125,294,749	16,717,937	(*l*) 2,983,245	.....	41,536,685	21,857,550	67,291,895	116,600	27,969	
23,151,494	22,264,814	182,899,743	16,713,900	3,739,915	37,409,904	1,255,919	2,419,741	45,058,199	56,560	9,479	
40,974,374	45,358,475	117,612,513	2,452,294	177,823	32,681,000	30,681,000	12,657,177	33,285,149	80,574	9,266	
28,061,136	20,945,781	139,551,732	10,718,564	(*l*) 1,824,043	12,582,951	25,751,552	14,903,826	49,429,862	75,902	14,000	
26,049,368	28,392,387	49,426,461	20,014,171	(*l*) 4,196,844	4,297,110	111,940,326	10,706,189	41,504,977	65,054	12,513	
0	0	0	0	0	0	241,996,726	.....	4,324,311	0	0	
22,824,305 (*k*)	101,741,234	(*k*)	30,946,823	.....	.....	.....	.....	42,666,978	38,105 (*k*)	6,572	(*k*
8,252,862	15,107,282	97,208,262	6,607,236	.....	4,524,588	8,811,170	32,089,439	7,316,046	19,584	3,405	

55	Interstate Public Service Company	11	48,927	5	5,430	303,769,447	152,704,970	151,064,477
56	Wisconsin Power & Light Company	8	25,300	37	39,185	296,527,833	233,648,779	62,879,054
57	Illinois Electric Power Company	2	83,000	0	0	246,321,037	242,753,637	3,567,400
		1	50,000	0	0	198,179,340	198,179,340	0

Supplement to ELECTRICAL WORLD, May 3, 1930

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—Detailed Data on Generator Rating, Output, Custome of All Systems Having an Output Over 100,000,000 K

1, 1929	Generated and Purchased Output, 1929			Distribution of Output in Kilowatt-Hours, 1929						
o Plants										
Rating of Generators, Kw. (6)	Total Output, Kw.-Hr. (7)	Generated (Net) Kw.-Hr. (8)	Purchased, Kw.-Hr. (9)	Residential Service (10)	Commercial Light and Small Power (11)	Wholesale Energy (12)	Municipal Service (See Note *a*) (13)	Other Sales (Heating, etc.) (14)	Electrical Railway Operation (See Note *b*) (15)	Sold to Other Public Utilities (See Note *a*) (16)
171,300	1,703,536,819	1,354,453,510	349,083,309	101,567,123	93,291,002	636,525,329	32,577,007		103,848,418	474,474,138
50	1,041,388,668	992,446,066	48,942,602	125,992,850	182,493,292	305,250,482	27,218,947		7,942,207	228,752,696
53,870	580,426,439	532,057,149	48,369,290	46,288,263	29,255,150	261,306,985	6,952,826		52,922,404	93,373,343
66,985	494,805,982	329,717,260	165,088,722	30,720,380	25,121,169	228,214,653	9,471,617	(*n*) 18,288,329	32,120,387	74,251,588
1,500	362,855,320	248,387,050	(*p*) 114,468,270	29,001,353	59,119,725	64,209,853	6,187,020		26,908,000	124,506,894
0	338,215,600	338,215,600	0	0	0	0	0	0	0	338,215,600
0	(*c*) 288,417,200	(*c*) 288,417,200	0	(*e*)	(*e*)	(*e*) 248,348,354			0	4,323,700
61,770	270,606,693	239,468,358	31,138,335	(*E*) 16,453,870	14,804,600	142,950,638	7,260,950	8,270,927	9,374,650	8,822,362
0	219,020,744	219,020,744	0	(*d*) 17,631,696	(*d*)	156,975,802	2,796,467			20,867,948
1,750	207,701,144	24,341,219	183,359,925	12,425,191	13,969,916	131,561,052	3,311,839			19,777,772
22,500	144,364,260	139,663,960	4,700,300	14,184,929	17,007,276	36,602,204	4,491,434	1,262,213	17,218,303	30,395,480
0	(*c*) 127,820,205	(*c*) 127,781,650	38,555	3,122,753	3,059,499	23,187,751	1,073,080	91,196	5,650,100	83,976,350
379,725	5,779,159,074	4,833,969,766	945,189,308							
944,445	7,212,743,072	6,171,107,190	1,041,635,882	308,736,211	481,632,171	4,764,518,112	141,244,510		258,983,173	544,215,014
0	4,678,700,000	4,678,700,000	0	(*v*) 3,207,600,000	(*v*)	(*v*)	158,700,000	(*v*)	307,900,000	238,800,000
252,165	3,029,885,631	2,986,777,500	43,108,131	239,871,581	229,058,815	1,137,161,806	56,473,289		487,110,935	500,558,155
0	2,134,581,298	1,802,207,845	332,373,453	254,787,165	269,796,988	1,009,026,506	60,555,099		203,356,617	16,194,480
55,595	1,938,955,818	1,904,547,998	34,407,820	110,242,688	97,801,099	1,350,021,274	33,602,802		84,892,112	23,041,342
0	1,573,445,327	1,560,187,937	13,257,390	181,243,109	121,619,905	824,447,973	31,954,035		223,884,261	629,432
43,472	1,251,104,868	790,945,098	460,159,770	92,660,130	78,272,059	757,868,943	33,501,320			119,146,529
19,728	735,612,022	692,857,096	42,754,926	42,880,170	36,773,400	383,014,425	9,333,692		30,010,096	106,254,250
111,000	610,962,200	610,962,200	0	0	0	0	0	0	0	564,557,600
47,870	393,506,327	362,373,824	31,132,503	52,075,824	(*k*) 197,633,647	(*k*)	18,650,992		45,210,072	13,059,472
14,872	377,746,958	210,297,091	167,449,867	49,555,159	106,864,062	72,968,113	13,439,097		7,920,714	69,578,122
0	364,412,911	197,445,863	166,967,048	30,779,713	46,855,832	193,457,512	3,854,075		3,825,010	10,056,323
0	240,508,000	238,395,000	2,113,000	22,357,000	26,689,000	132,228,000	(*j*)	(*j*) 5,380,000	24,000,000	1,831,000
4,420	237,817,248	234,863,383	2,953,865	23,094,390	12,816,101	121,913,324	5,035,219		15,850,558	21,994,314
0	216,503,601	0	(*y*) 216,503,601	(*e*) 115,211,191	(*e*)	(*e*)	15,485,965	2,500,221	1,201,000	1,509,326
25,925	200,566,867	82,000,300	118,566,567	17,645,665	26,420,178	53,898,536	10,233,729	358,758	2,319,192	55,485,253
0	197,097,106	197,089,076	8,030	(*z*) 143,234,728	(*z*)	(*z*)	(*z*)		0	2,932
0	184,172,000	151,380,000	32,792,000	28,134,000	27,269,000	69,608,000	(*j*)	(*j*) 19,202,000	1,326,000	1,008,000
300	140,850,741	0	140,850,741	14,925,129	15,840,425	77,640,703	9,292,231			2,533,547
0	128,665,860	128,399,460	266,400	13,350,678	7,460,222	56,977,635	8,242,720		26,198,088	3,311,200
0	126,624,123	123,678,248	2,945,875	6,633,567	10,971,508	46,979,806	274,227		6,795,844	
0	115,530,335	123,821,989	(*A*) —8,291,654	10,803,764	5,541,587	82,714,607	2,730,168		1,306,149	688,350
1,519,792	26,089,992,313	23,248,037,098	2,841,955,215							
0	4,636,434,000	3,826,748,000	809,686,000	483,645,000	552,449,000	1,695,943,000	124,689,000	219,000	964,749,000	360,253,000
9,160	2,654,901,300	2,651,711,300	3,190,000	(*Q*) 305,349,876	537,709,658	1,124,678,978	63,010,138		137,432,900	119,754,990
2,850	1,544,252,000	1,374,674,000	169,578,000	68,669,000	106,727,000	624,380,000	(*j*)	(*j*) 26,223,000	5,302,000	603,351,000
0	1,447,193,594	1,446,625,594	568,000	168,045,953	121,688,930	736,829,167	19,782,316	4,988,319	132,095,770	96,520,686
15,793	1,311,738,004	1,171,854,664	139,883,340	(*d*) 277,995,781	(*d*)	643,193,029	13,589,108		3,862,908	57,595,152
4,100	1,246,330,283	694,706,651	551,623,632	113,068,095	90,524,843	348,480,732	61,603,461	6,751,673	86,305,970	349,824,131
0	1,203,652,405	1,203,613,505	38,900	131,387,973	105,856,162	555,578,430	40,569,925		124,534,925	83,745,672
109,105	1,198,947,711	1,037,419,147	161,528,564	125,663,999	110,848,829	649,651,691	17,847,908		56,458,629	19,071,260
0	634,346,780	623,578,420	10,768,360	30,075,526	27,634,333	200,624,831	8,900,491		29,624,666	280,455,321
0	611,482,217	438,356,966	173,125,251	38,416,769	43,086,911	388,142,414	6,834,085		4,527,274	71,264,355
3,590	542,629,220	125,349,242	417,279,978	52,564,350	49,022,547	249,418,154	16,330,576	(*l*) 1,576,345	56,026,497	4,983,283
22,004	538,734,000	519,128,000	19,606,000	25,180,000	36,349,000	88,544,000	(*j*)	(*j*) 5,215,000	14,031,000	315,476,000
6,800	514,989,108	397,053,946	117,935,162	44,966,150	48,211,047	260,125,473	8,427,542		36,818,154	39,897,697
0	(*C*) 430,779,000	430,779,000	0	0	0	0	0	0	0	430,799,000
384	424,300,963	313,604,913	110,696,050	14,356,975	13,170,547	159,738,031	4,228,919	(*l*) 2,212,866	3,594,560	165,686,189
0	388,871,320	352,790,850	36,080,470	40,037,255	89,466,724	150,008,092	16,734,937	(*l*) 6,513,193		10,539,572
2,175	384,412,400	195,232,810	189,179,590	46,026,334	33,093,255	191,626,930	20,143,750		38,055,555	7,616,080
0	367,912,947	235,788,558	132,124,389	39,780,102	52,450,784	125,294,749	16,717,937	(*l*) 2,983,245		41,536,685
515	334,913,629	106,991,741	227,921,888	23,151,494	22,264,814	182,899,743	16,713,900	3,739,915	37,409,904	1,255,919
0	315,558,310	315,890,600	—332,290	40,974,374	45,358,475	117,612,513	2,452,294	177,823	32,681,000	30,681,000
5,430	303,769,447	152,704,970	151,064,477	28,061,136	20,945,781	139,551,732	10,718,564	(*l*) 1,824,043	12,582,951	25,751,552
39,185	296,527,833	233,648,779	62,879,054	26,049,368	28,392,387	49,426,461	20,014,171	(*l*) 4,196,844	4,297,110	111,940,326
0	246,321,037	242,753,637	3,567,400	0	0	0	0	0	0	241,996,726
38	The Cleveland Electric Illuminating Company	4	447,000	0	0	1,447,193,594	1,446,625,594	568,000		168

ers and Distribution of Energy
Kw.-Hr. During 1929

olic (a)	Intra-Company Business (See Note b) (17)	Not Accounted for (Losses) (18)	Number of Customers, Dec. 31, 1929: Residential (19)	Commercial Light and Small Power (20)	Wholesale (21)	Municipal Service (22)	Other Sales (Heating, etc.) (23)	Electric Railway (24)	Other Public Utilities (25)	Line No. (26)
,138	12,174,113	249,079,699	278,080	39,107	9,105	90	.....	7	58	1
,696	3,084,234	160,653,960 (m)	281,497 (m)	69,923 (m)	513 (m)	40	..... (m)	3 (m)	10	2
,343	9,055,522	81,271,946	96,068	14,257	2,519	.....	.....	.....	.....	3
,588	7,135,992	69,481,867	71,052	11,502	2,845	57	(n) 3	4	12	4
,894 (q)	18,471,200	34,451,275	58,243	10,206	60	29	0	1	6	5
,600	0	(r)	0	0	0	0	0	3	0	6
,700	.....	35,745,146	100,819	(k)	(k) 18,495	.....	.....	0	.....	7
,362	14,660,331	48,008,365 (E)	55,738	9,602	1,783	802	639	4	10	8
,948	2,038,070	18,710,761 (g)	34,008 (g)	6,700 (g)	75	167	.....	.....	1	9
,772	523,120	26,132,254	40,173	5,763	422	209	.....	.....	4	10
,480	912,721	22,289,700	33,480	6,422	1,902	363	2,779	.....	5	11
,350 (s)	4,321,636	3,337,840	9,324	2,012	488	1	27	1	1	12
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
,014	24,969,486	688,444,395	546,278	90,029	3,641	775	.....	28	66	13
,000	(i)	(i) 765,700,000 (f, h)	2,143,431	(h)	(h)	(h)	(h)	(h)	(h)	14
,155	22,803,428	356,847,622 (f)	501,283 (f)	91,504 (f)	30,383 (f)	4	..... (f)	166 (f)	31	15
,480	14,615,972	306,248,471 (f, d)	847,068	(d)	39,718	.....	..... (f)	5 (f)	6	16
,342	(i)	(i) 239,354,501	218,942	40,353	6,740	2,112	.....	44	38	17
,432	6,993,118	182,673,494	269,552	32,714	1,795	184	.....	1	3	18
,529	.....	169,655,887	235,647	40,194	7,749	1,699	.....	.....	47	19
,250	7,131,320	120,214,669	111,447	22,096	3,971	816	.....	16	18	20
,600	0	46,404,600	0	0	0	0	0	0	5	21
,472	15,350,627	51,525,542	104,214 (k)	11,889	(k)	49	.....	1	4	22
,122	12,651,775	44,769,916	115,147	21,420	95	787	.....	5	26	23
,323	4,643,039	70,941,407	71,639	13,502	394	188	.....	3	13	24
,000	.....	28,023,000	61,743	9,693	331	(j)	(j) 27	2	4	25
,314	2,203,902	34,909,440	48,432	6,360	1,692	376	.....	3	24	26
,326	43,129,862	37,466,036 (h)	133,345	(h)	(h)	(h)	(h)	(h)	(h)	27
,253	5,437,648	28,767,908	45,922	12,373	91	179	149	4	8	28
,932	5,973,694	47,885,752 (h)	128,955	(h)	(h)	(h)	.....	0	(h)	29
,000	.....	37,625,000	71,564	12,066	670	(j)	(j) 475	4	1	30
,547	.....	20,618,706	37,851	4,886	3,145	377	.....	.....	9	31
,200	861,283	12,264,034	33,588	4,876	725	157	.....	2	1	32
....	39,838,720	15,130,451	14,810	2,135	28	5	.....	1	.....	33
,350	1,154,117	10,591,593	29,725	3,171	813	162	.....	2	2	34
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
,000	19,896,000	434,591,000	816,243	131,266	3,176	4	98	5	.....	35
,990	36,734,800	330,229,900 (Q)	483,716	85,378	413	173	.....	4	2	36
,000	.....	109,600,000	160,356	31,442	394	(j)	(j) 1,189	5	52	37
,686	4,832,556	162,409,897	272,282	34,920	1,452	103	279	2	2	38
,152	137,677,121	177,824,905 (d)	281,203	(d)	11,627	429	.....	82	22	39
,131	11,292,095	178,479,283	234,473	41,709	703	1,596	3,939	8	10	40
,672	29,242,374	132,736,944	269,023	36,132	8,987	505	.....	15	8	41
,260	10,959,383	208,446,012	250,106	36,268	9,662	.....	.....	.....	.....	42
,321	1,227,703	55,803,909	53,205	7,119	423	319	.....	.....	.....	43
,355	2,079,294	57,130,515	69,039	12,046	265	26	.....	.....	14	44
,283	5,020,029	107,687,439	152,120	27,165	6,972	363	(l) 2,921	.....	24	45
,000	.....	53,939,000	54,376	8,733	60	(j)	(j) 215	19	11	46
,697	3,809,244	72,733,801	86,723	10,004	2,165	26	.....	3	15	47
,000	0	0	0	0	0	0	0	0	2	48
,189	1,484,022	59,768,854	42,106	8,914	2,022	151	(l) 4,555	.....	143	49
,572	13,508,190	62,063,357	87,384	12,488	250	8	(l) 10,566	.....	2	50
,080	1,729,937	46,120,559	72,621	9,015	1,936	.....	.....	.....	.....	51
,685	21,857,550	67,291,895	116,600	27,969	194	1,508	(l) 5,630	.....	16	52
,919	2,419,741	45,058,199	56,560	9,479	1,993	331	2,002	2	4	53
,000	12,657,177	33,285,149	80,574	9,266	1,203	.....	.....	.....	.....	54
,552	14,903,826	49,429,862	75,902	14,000	3,606	238	(l) 3,642	.....	42	55
,326	10,706,189	41,504,977	65,054	12,513	3,952	28	(l) 7,207	.....	29	56
,726	.....	4,324,311	0	0	0	0	0	0	5	57
		42,666,978	38,105 (k)	6,572 (k)		145	.....	.....	.....	58
168,043,953	121,688,930	736,829,167	19,782,316	4,988,319		132,095,770	96,520,686	4,832,556	162,409,897	272,282	34,920

(a) "Municipal service" was intended to include only energy used by municipalities as ultimate consumers (also for lighting county, state or federal buildings). Sales to municipalities for resale are considered as "sales to other public utilities," and were so allocated when separately reported. In some cases no such distinction could be made.

(b) Energy for company-owned electric railways has, where the information was available, been included under "electric railway operation," necessary adjustments having been made in company reports where the data were given, but was in some cases apparently included under "intra-company business" by the reporting companies.

(c) Gross.

(d) Commercial light and small power combined with residential service.

(e) Residential service, commercial light and small power, and wholesale combined.

(f) Customers' meters.

(g) Estimated.

(h) Customers of all classes included under "residential."

(i) Intra-company business included with losses.

(j) Municipal service included with "other sales."

(k) Commercial light and small power combined with wholesale.

(l) Rural.

(m) Bills rendered in December.

(n) Electricity exchanged for water power.

(o) 40,000 kw. started December 26, 1929.

(p) Includes exchange 73,124,300 kw.-hr.

(q) Exchange.

(r) All energy sold at low tension bus of generating station.

(s) Includes current for exciters and auxiliaries.

39,185	296,527,833	233,648,779	62,879,054	26,049,368	28,392,387		49,426,461	20,014,171	(I)	4,196,844	4,297,110	111,940,32
0	246,321,037	242,753,637	3,567,400	0	0		0	0		0	0	241,996,72
38	The Cleveland Electric Illuminating Company	4		447,000	0		0	1,447,193,594		1,446,625,594	568,000	
39	The North American Co. System (Wis.-Michigan Group)	11		361,884	9		15,793	1,311,738,004		1,171,854,664	139,883,340	(d) 2
40	Public Service Company of Northern Illinois	15	(B)	246,275	3		4,100	1,246,330,283		694,706,651	551,623,632	1
41	Columbia Gas & Electric Corporation System	9		401,050	0		0	1,203,652,405		1,203,613,505	38,900	1
42	Consumers Power Company	10		236,200	33		109,105	1,198,947,711		1,037,419,147	161,528,564	1
43	The Pennsylvania-Ohio Power & Light Company	3		212,000	0		0	634,346,780		623,578,420	10,768,360	
44	The Ohio Public Service Company	8		130,100	0		0	611,482,217		438,356,966	173,125,251	
45	Illinois Power & Light Corporation (Illinois)	20		100,605	1		3,590	542,629,220		125,349,242	417,279,978	
46	Indiana & Michigan Electric Company	2		94,000	4		22,004	538,734,000		519,128,000	19,606,000	
47	The Toledo Edison Company	4		160,200	2		6,800	514,989,108		397,053,946	117,935,162	
48	State Line Generating Company	1		200,000	0		0	(C) 430,779,000		430,779,000	0	
49	Central Indiana Power Company Subsidiaries	11		92,285	1		384	424,300,963		313,604,913	110,696,050	
50	Indianapolis Power & Light Company	3		103,200	0		0	388,871,320		352,790,850	36,080,470	
51	Northern Ohio Power & Light Company	1		67,000	1		2,175	384,412,400		195,232,810	189,179,590	
52	Central Illinois Public Service Company	8		84,225	0		0	367,912,947		235,788,558	132,124,389	
53	Northern Indiana Public Service Company	2		33,600	5		515	334,913,629		106,991,741	227,921,888	
54	The Columbus Railway, Power & Light Company	3		144,000	0		0	315,558,310		315,890,600	—332,290	
55	Interstate Public Service Company	11		48,927	5		5,430	303,769,447		152,704,970	151,064,477	
56	Wisconsin Power & Light Company	8		25,300	37		39,185	296,527,833		233,648,779	62,879,054	
57	Illinois Electric Power Company	2		83,000	0		0	246,321,037		242,753,637	3,567,400	
58	City of Cleveland, Division of Light & Power	1		50,000	0		0	198,179,340		198,179,340	0	
59	Indiana Service Corporation	1		31,000	0		0	180,016,985		138,292,500	41,724,485	
60	Central Illinois Light Company	0		0	0		0	177,338,443		0	177,338,443	
61	Wisconsin Public Service Corporation and Subsidiary	3		39,750	9		29,620	176,194,115		166,571,745	9,622,370	
62	Moline-Rock Island Manufacturing Company	2		78,280	0		0	164,206,522		125,585,710	38,620,812	
63	Indiana General Service Company	3		40,950	0		0	145,405,000		47,690,000	97,715,000	
64	Terre Haute, Indianapolis & Eastern Traction Company	6		48,150	0		0	143,058,177		86,910,488	56,147,689	(d
65	Lansing, Mich., Board of Water & Elec. Light Commissioners	3		58,250	1		1,000	101,601,476		101,601,476	0	
	Totals for section	179		5,916,076	122		251,711	22,864,997,566		18,955,836,552	3,909,161,014	
	West North Central States											
66	The North American Co. Sys. (Mo., Ill. and Iowa Group)	7		437,020	1		135,000	1,871,797,392		1,871,760,733	36,659	1
67	Northern States Power Company (Del.) Subsidiaries	23		231,210	27		133,390	969,071,015		905,312,268	63,758,747	1
68	Kansas City Power & Light Company	4		207,975	0		0	645,165,032		644,962,949	202,083	
69	Minnesota Power & Light Company	4		11,300	11		94,911	427,848,189		426,918,526	929,663	
70	Kansas Gas & Electric Company	4		72,160	0		0	284,354,000		284,171,400	182,600	
71	Nebraska Power Company	2		73,140	1		126	265,901,500		265,772,200	129,300	
72	The Empire District Electric Company	2		78,300	4		4,000	258,682,003		258,467,390	214,613	
73	Des Moines Electric Light Company	3		91,940	1		800	172,539,101		171,845,201	693,900	
74	Sioux City Gas & Elec. Co., Iowa Pub. Serv. Co. System	16		76,410	4		2,075	(D) 162,477,080		158,931,127	3,545,953	
75	Kansas Power & Light Company	6		44,675				122,992,015		120,663,146	2,328,869	
76	United Power & Light Corporation (of Kansas)	10		44,815	5		3,895	103,802,181		103,175,199	626,982	
	Totals for Section	81		1,368,945	54		374,197	5,284,629,508		5,211,980,139	72,649,369	
	South Atlantic States											
77	Duke Power Company	8	(G)	306,650	38	(G)	504,455	1,981,239,709		1,795,042,777	186,196,932	(
78	Appalachian Electric Power Company	8		302,540	5		36,900	1,484,761,000		1,379,269,000	105,492,000	4
79	Georgia Power Company	7	(I)	11,836	13	(I)	203,475	1,146,516,743		762,499,678	384,017,065	5
80	Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore	3		257,000	1		600	910,934,486		569,588,764	341,345,722	10
81	Virginia Electric & Power Company	7		132,768	9		28,650	480,970,175		464,923,075	16,047,100	3
82	Carolina Power & Light Company	4		46,750	11		98,300	476,878,300		418,548,300	58,330,000	2
83	Potomac Electric Power Company	1		178,000	0		0	449,794,685		449,794,685	0	(J) 6
84	Columbus Electric & Power Company and Subsidiaries	5	(K)	12,080	9	(K)	77,096	370,871,354		370,721,810	149,544	
85	Florida Power & Light Company	38		138,196	0		0	202,110,030		202,110,030	0	3
86	Tampa Electric Company	4		37,075	1		600	170,887,397		156,365,397	14,522,000	1
87	Broad River Power Company	2		78,000	3		24,705	162,129,679		143,206,234	18,923,445	(d) 1
88	South Carolina Power Company	6	(L)	20,388	2	(L)	16,500	136,213,088		135,696,375	516,713	
89	Delaware Power & Light Company	2		25,000	0		0	134,571,700		47,607,700	86,964,000	1
90	Wheeling Electric Company	2		9,360	0		0	119,716,000		1,305,000	118,411,000	1
	Totals for section	97		1,555,643	92		991,281	8,227,594,346		6,896,678,825	1,330,915,521	
	East South Central States											
91	Alabama Power Company	15	(N)	151,246	6	(N)	348,540	1,715,250,122		1,456,341,776	258,908,346	4
92	The Tennessee Electric Power Company	4		103,750	7		108,052	819,723,857		751,258,607	68,465,250	3
93	Louisville Gas & Electric Company (Del.) Subsidiaries	2		93,520	1		80,320	328,598,520		311,128,820	17,469,700	3
94	Birmingham Electric Company	1		11,700	0		0	292,759,162		0	292,759,162	2
95	Kentucky Utilities Company	27		60,867	2		24,540	240,724,354		207,631,696	33,092,658	1
96	Kentucky & West Virginia Power Company, Inc.	1		19,500	0		0	211,444,000		41,442,000	170,002,000	
97	Memphis Power & Light Company	1		54,000	0		0	182,112,000		180,208,000	1,904,000	1
98	U. S. Government (Muscle Shoals)	0		0	1		184,000	171,681,600		171,681,600	0	
99	Mississippi Power Company	24	(O)	26,881	0		0	116,745,731		24,341,898	92,403,833	1
100	Knoxville Power & Light Company	1		6,000	0		0	111,870,280		0	111,870,280	
101	Mississippi Power & Light Company	41		25,508	0		0	103,748,759		2,816,157	100,932,602	1
	Totals for section	117		552,972	17		745,452	4,294,658,385		3,146,850,554	1,147,807,831	
	West South Central States											
102	Oklahoma Gas & Electric Company	30		160,775	0		0	692,070,936		606,426,649	85,644,287	3
103	Texas Electric Service Company	15		93,697	0		0	665,625,000		522,443,000	143,182,000	
104	Louisiana Power & Light Company	15		90,782	0		0	511,225,000		441,079,000	70,146,000	
105	Houston Lighting & Power Company	4		132,956	0		0	510,247,000		505,627,000	4,620,000	2
106	Texas Power & Light Company	22		65,388	3		340	442,818,000		301,388,000	141,430,000	3
107	New Orleans Public Service, Inc.	3		112,700	0		0	345,847,000		345,847,000	0	2
108	Arkansas Power & Light Company	48		41,894	2		9,666	310,955,000		65,731,000	245,224,000	1
109	Gulf States Utilities Company	11		82,008	(P) 15	(P)	2,179	273,182,834		268,381,134	4,801,700	1
110	Public Service Company of Oklahoma	14		65,245	0		0	255,220,126		225,018,659	30,201,467	2
111	West Texas Utilities Company	21		38,592	0		0	246,515,315		234,532,572	11,982,743	1
112	Central Power & Light Company	56		61,022	4		5,250	239,756,655		194,697,068	45,059,587	1
113	San Antonio Public Service Company	6		91,880	2		650	238,200,935		213,522,395	24,678,540	1
114	Dallas Power & Light Company	1		57,500	0		0	199,099,200		197,242,900	1,856,300	2
115	Southwestern Gas & Electric Company	17		46,578	0		0	149,696,794		130,122,314	19,574,480	1
	Totals for section	263		1,141,017	26		18,085	5,080,459,795		4,252,058,691	828,401,104	
	Mountain States											
116	The Montana Power Company	2		900	10		248,400	1,611,521,000		1,582,693,000	28,828,000	3
117	Pacific Power & Light Company	5		42,540	41		189,347	882,360,000		613,200,000	269,160,000	4

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	Mountain States											
116	The Montana Power Company			2	900	10	248,400	1,611,521,000	1,582,693,000		28,828,000	
				4	42,540	41	189,347	882,360,000	613,200,000		269,160,000	
0	1,447,193,594	1,446,625,594	568,000	168,045,953	121,688,930	736,829,167		19,762,316	4,966,319		132,695,770	96,520,668
15,793	1,311,738,004	1,171,854,664	139,883,340 (d)	277,995,781	(d)	643,193,029		13,589,108			3,862,908	57,595,152
4,100	1,246,330,283	694,706,651	551,623,632	113,068,095	90,524,843	348,480,732		61,603,461	6,751,673		86,305,970	349,824,131
0	1,203,652,405	1,203,613,505	38,900	131,387,973	105,856,162	555,578,430		40,569,925			124,534,925	83,745,672
109,105	1,198,947,711	1,037,419,147	161,528,564	125,663,999	110,848,829	649,651,691		17,847,908			56,458,629	19,071,260
0	634,346,780	623,578,420	10,768,360	30,075,526	27,634,333	200,624,831		8,900,491			29,624,666	280,455,321
0	611,482,217	438,356,966	173,125,251	38,416,769	43,086,911	388,142,414		6,834,085			4,527,274	71,264,355
3,590	542,629,220	125,349,242	417,279,978	52,564,350	49,022,547	249,418,154		16,330,576 (l)	1,576,345		56,026,497	4,983,283
22,004	538,734,000	519,128,000	19,606,000	25,180,000	36,349,000	88,544,000		(j)	5,215,000 (j)		14,031,000	315,476,000
6,800	514,989,108	397,053,946	117,935,162	44,966,150	48,211,047	260,125,473		8,427,542			36,818,154	39,897,697
0	(C)430,779,000	430,779,000	0	0	0	0		0	0		0	430,799,000
384	424,300,963	313,604,913	110,696,050	14,356,975	13,170,547	159,738,031		4,228,919 (l)	2,212,866		3,594,560	165,686,189
0	388,871,320	352,790,850	36,080,470	40,037,255	89,466,724	150,008,092		16,734,937 (l)	6,513,193			10,539,572
2,175	384,412,400	195,232,810	189,179,590	46,026,334	33,093,255	191,626,930		20,143,750			38,055,555	7,616,080
0	367,912,947	235,788,558	132,124,389	39,780,102	52,450,784	125,294,749		16,717,937 (l)	2,983,245			41,536,685
515	334,913,629	106,991,741	227,921,888	23,151,494	22,264,814	182,899,743		16,713,900	3,739,915		37,409,904	1,255,919
0	315,558,310	315,890,600	—332,290	40,974,374	45,358,475	117,612,513		2,452,294	177,823		32,681,000	30,681,000
5,430	303,769,447	152,704,970	151,064,477	28,061,136	20,945,781	139,551,732		10,718,564 (l)	1,824,043		12,582,951	25,751,552
39,185	296,527,833	233,648,779	62,879,054	26,049,368	28,392,387	49,426,461		20,014,171 (l)	4,196,844		4,297,110	111,940,326
0	246,321,037	242,753,637	3,567,400	0	0	0		0	0		0	241,996,726
0	198,179,340	198,179,340	0	22,824,305 (k)	101,741,234	(k)		30,946,823				
0	180,016,985	138,292,500	41,724,485	8,252,862	15,107,283	97,308,363		6,607,236			4,524,588	8,811,170
0	177,338,443	0	177,338,443	17,140,613	12,851,496	119,010,474		4,427,676				7,779,805
29,620	176,194,115	166,571,745	9,622,370	13,347,368	12,571,891	88,085,707		4,757,139			906,870	25,305,137
0	164,206,522	125,585,710	38,620,812	0	0	0		0	57,240		24,691,153	134,447,181
0	145,405,000	47,690,000	97,715,000	12,927,000	20,108,000	90,090,000		(j)	5,721,000 (j)		11,000	1,443,000
0	143,058,177	86,910,488	56,147,689	(d)	(d) 82,429,966	7,291,114		2,949,454			38,548,223	880,960
1,000	101,601,476	101,601,476	0	13,147,519	21,918,971	56,396,628		3,487,500				
251,711	22,864,997,566	18,955,836,552	3,909,161,014									
135,000	1,871,797,392	1,871,760,733	36,659	153,872,651	168,991,975	785,949,341		46,846,856			1,368,280	486,161,432
133,390	969,071,015	905,312,268	63,758,747	130,412,332	143,135,304	375,586,292		75,125,011			1,907,536	46,099,832
0	645,165,032	644,962,949	202,083	61,161,457	64,619,442	273,331,113		28,808,849			132,405,014	23,008,567
94,911	427,848,189	426,918,526	929,663	17,140,028	18,979,289	236,487,549		21,569,292				59,430,546
0	284,354,000	284,171,400	182,600	25,295,013	22,969,918	141,785,405		6,583,826				35,521,384
126	265,901,500	265,772,200	129,300	30,496,727	41,800,782	123,417,916		7,126,291				37,804,800
4,000	258,682,003	258,467,390	214,613	6,983,666	9,488,595	150,601,439		1,160,487			7,411,450	33,810,548
800	172,539,101	171,845,201	693,900	20,792,570	12,076,477	76,343,804		7,848,073 (l)	403,584			28,793,712
2,075	(D) 162,477,080	158,931,127	3,545,953	21,973,921	21,962,448	60,585,666		9,731,279	2,785,369		4,773,747	10,216,400
	122,992,015	120,663,146	2,328,869	11,145,542	14,988,024	27,636,071		1,162,988 (l)	205,339		1,755,616	49,099,960
3,895	103,802,181	103,175,199	626,982	12,249,751	11,288,976	43,321,516		2,547,057 (l)	1,016,164		472,591	11,539,893
374,197	5,284,629,508	5,211,980,139	72,649,369									
) 504,455	1,981,239,709	1,795,042,777	186,196,932	(H)	(H)	1,610,526,418		(H)	(H)		(H)	(H)
36,900	1,484,761,000	1,379,269,000	105,492,000	44,812,000	65,359,000	922,487,000		(j)	(j) 11,890,000		26,577,000	293,548,000
) 203,475	1,146,516,743	762,499,678	384,017,065	55,882,884	106,885,332	516,986,966		9,991,622			62,958,925	154,796,885
600	910,934,486	569,588,764	341,345,722	107,270,622	98,932,591	463,235,360		19,267,643			125,488,240	
28,650	480,970,175	464,923,075	16,047,100	38,638,127	69,306,702	240,390,733		10,607,478			8,688,240	12,187,350
98,300	476,878,300	418,548,300	58,330,000	25,386,827	20,110,996	268,000,555		29,677,906				18,260,120
0	449,794,685	449,794,685	0 (J)	64,892,783	104,443,001	91,621,411		16,284,433			94,862,355	4,020,582
K) 77,096	370,871,354	370,721,810	149,544	6,325,631	(k)	(k) 174,164,938		4,316,013			980,647	145,201,966
0	202,110,030	202,110,030	0	39,380,070	27,695,751	49,730,519		21,859,394				4,590,158
600	170,887,397	156,365,397	14,522,000	11,209,202	17,701.473	108,252,589		3,453,088			7,817,489	812,030
24,705	162,129,679	143,206,234	18,923,445 (d)	10,819,541	(d)	94,200,403		3,685,055				6,266,510
L) 16,500	136,213,088	135,696,375	516,713	5,395,825	(k)	(k) 61,374,692		2,398,761	140,863		3,833,469	48,133,617
0	134,571,700	47,607,700	86,964,000	12,581,155	12,156,361	74,216,779		1,567,765	0		15,174,775	5,342,721
0	119,716,000	1,305,000	118,411,000	10,155,000	24,645,000	60,445,000		(j)	(j) 5,563,000		3,839,000	
991,281	8,227,594,346	6,896,678,825	1,330,915,521									
N) 348,540	1,715,250,122	1,456,341,776	258,908,346	40,856,914	65,400,308	658,463,053		15,424,065	1,529,399		9,421,408	652,047,341
108,052	819,723,857	751,258,607	68,465,250	39,901,167	29,767,699	419,209,810		3,591,348			4,332,520	156,919,878
80,320	328,598,520	311,128,820	17,469,700	34,220,235	46,143,247	119,075,176		22,421,288	457,800		5,573,900	65,919,878
0	292,759,162	0	292,759,162	21,865,397	31,771,479	154,591,373		3,733,921				
24,540	240,724,354	207,631,696	33,092,658	12,475,334	31,309,057	88,326,414		6,553,587	2,212,955			62,345,930
0	211,444,000	41,442,000	170,002,000	5,931,000	12,839,000	162,921,000		(j)	(j) 2,385,000		1,261,000	3,434,000
0	182,112,000	180,208,000	1,904,000	18,882.770	41,486,604	48,948,335		5,715,210				44,657,759
184,000	171,681,600	171,681,600	0	0	0	0		0	0		0	165,821,000
0	116,745,731	24,341,898	92,403,833	11,603,767	(k)	(k) 74,912,624		3,138,234	359,791		695,180	2,292,806
0	111,870,280	0	111,870,280	8,913,959	12,278,986	68,303,164		2,429,345				
0	103,748,759	2,816,157	100,932,602	10,734,760	11,117,763	36,908,320		9,973,273				5,857,073
745,452	4,294,658,385	3,146,850,554	1,147,807,831									
0	692,070,936	606,426,649	85,644,287	39,150,310	48,418,333	430,204,719		18,103,575			22,128,973	19,154,804
0	665,625,000	522,443,000	143,182,000									
0	511,225,000	441,079,000	70,146,000	4,360,958	4,374,642	144,798,523		2,968,829				336,380,572
0	510,247,000	505,627,000	4,620,000	28,976,059	21,693,658	316,494,702		23,841,351				71,740,484
340	442,818,000	301,388,000	141,430,000	33,439,424	23,072,781	238,384,746		24,698,371				42,226,710
0	345,847,000	345,847,000	0	29,918,466	28,614,032	121,716,863		14,290,041				69,074,199
9,666	310,955,000	65,731,000	245,224,000	16,177,671	22,195,438	152,486,509		9,785,540				29,044,163
P) 2,179	273,182,834	268,381,134	4,801,700	12,873,124	22,672,213	174,284,763		4,786,387			4,191,954	8,814,065
0	255,220,126	225,018,659	30,201,467	21,165,113	21,141,118	99,940,147		3,939,693	1,078,328		5,859,869	63,895,720
0	246,515,315	234,532,572	11,982,743	18,066,843	19,997,522	103,733,859		4,519,627 (l)	963,340		293,970	46,298,666
5,250	239,756,655	194,697,068	45,059,587	11,295,732	16,596,630	(Q) 124,584,397		6,968,902	3,605,977			2,968,530
650	238,200,935	213,522,395	24,678,540	18,032,895	55,042,530	41,506,641		3,601,855			11,768,560	70,794,676
0	199,099,200	197,242,900	1,856,300	26,252,083	29,906,683	72,477,577		13,595,648				34,119,296
0	149,696,794	130,122,314	19,574,480	13,535,422	22,792,166	63,554,012		7,203,642	2,497,968		7,717,259	5,325,048
18,085	5,080,459,795	4,252,058,691	828,401,104									
248,400	1,611,521,000	1,582,693,000	28,828,000	30,162,023	29,941,030	1,177,425,879		16,943,227				138,210,861
189,347	882,360,000	613,200,000	269,160,000	45,676,048	42,249,071	602,298,259		12,956,343				49,648,156

30,162,023	29,941,030	1,177,425,879		16,943,227				138,210,861	4,812,465	214,025,515	49,837	11,707
45,676,048	42,249,071	602,298,259		12,956,343				49,648,156		129,532,123	86,648	12,439
4,852,530	162,409,897	272,282		54,920	1,452	103		279	2	2	38	
137,677,121	177,824,905	(d) 281,203		(d)	11,627	429			82	22	39	
11,292,095	178,479,283	234,473		41,709	703	1,596		3,939	8	10	40	
29,242,374	132,736,944	269,023		36,132	8,987	505			15	8	41	
10,959,383	208,446,012	250,106		36,268	9,662						42	
1,227,703	55,803,909	53,205		7,119	423	319					43	
2,079,294	57,130,515	69,039		12,046	265	26				14	44	
5,020,029	107,687,439	152,120		27,165	6,972	363	(l)	2,921		24	45	
	53,939,000	54,376		8,733	60	(j)	(j)	215	19	11	46	
3,809,244	72,733,801	86,723		10,004	2,165	26			3	15	47	
0	0	0		0	0	0		0	0	2	48	
1,484,022	59,768,854	42,106		8,914	2,022	151	(l)	4,555		143	49	
13,508,190	62,063,357	87,384		12,488	250	8	(l)	10,566		2	50	
1,729,937	46,120,559	72,621		9,015	1,936						51	
21,857,550	67,291,895	116,600		27,969	194	1,508	(l)	5,630		16	52	
2,419,741	45,058,199	56,560		9,479	1,993	331		2,002	2	4	53	
12,657,177	33,285,149	80,574		9,266	1,203						54	
14,903,826	49,429,862	75,902		14,000	3,606	238	(l)	3,642		42	55	
10,706,189	41,504,977	65,054		12,513	3,952	28	(l)	7,207		29	56	
	4,324,311	0		0	0	0		0	0	5	57	
	42,666,978	38,105	(k)	6,572	(k)	145					58	
32,089,439	7,316,046	19,584		3,405	2,132	46			2	2	59	
134,949	15,993,430	34,387		5,897	1,431						60	
4,429,262	26,790,741	33,927		5,959	1,759	48			1	9	61	
1,270,948	3,740,000	0		0	0	0		2	3	3	62	
	15,105,000	29,948		4,414	79	(j)	(j)	333	1	4	63	
	10,958,460	(d)		(d) 28,146	7	17			2	1	64	
	6,650,858	21,043		2,616	72						65	
28,317,438	200,289,419	275,574		42,966	447	47				26	66	
14,820,164	181,984,544	282,138		47,922	18,524	684			3	87	67	
2,996,792	58,833,798	104,430		20,939	3,906	365			1	8	68	
	74,241,485	36,620		6,991	1,788	724				7	69	
	52,198,454	49,678		8,395	2,065	72				16	70	
	25,254,984	56,202		8,195	2,021	32				2	71	
1,072,626	48,153,192	19,479		5,719	1,493	50				12	72	
822,056	25,458,825	45,036		4,589	1,933	34	(l)	843		7	73	
2,701,348	27,746,902	58,747		11,462	3,554	305		1,804	1	39	74	
1,715,910	15,282,565	26,739		4,389	1,744	33	(l)	342		16	75	
2,747,228	18,619,005	25,708		6,471	1,800	121	(l)	1,288		29	76	
	370,713,291	(H)		(H)	682	(H)		(H)	(H)	(H)	77	
	120,088,000	84,906		17,374	538	(j)	(j)	296	10	32	78	
7,784,238	230,596,578	92,237		28,716	395	254		1,324		37	79	
9,482,453	87,257,577	189,445		24,898	275	21			1		80	
41,586,379	59,565,166	89,363		17,596	971	484			6	11	81	
5,970,607	109,471,289	51,404		15,396	2,997	747				4	82	
1,599,283	72,070,837	(J) 117,947		16,904	120	38				2	83	
4,905,987	34,976,172	14,812		5,090	175	89				11	84	
12,195,899	46,658,239	76,602		17,209	5,248	825				3	85	
1,644,746	19,996,780	27,769		5,603	51	108				3	86	
22,245,854	24,912,316	(d) 13,563		(d)	287	54				3	87	
2,799,033	12,136,828	13,317		(k)	(k) 5,338	54		73		3	88	
405,913	13,126,231	27,527		5,493	(M) 967	(M)		0	(M)	(M)	89	
	15,069,000	23,736		5,600	55	(j)	(j)	135	3		90	
13,154,324	258,953,310	73,373		26,650	693	206		2,735		17	91	
38,367,870	127,896,005	90,502		19,848	4,751	122			3	13	92	
4,075,468	30,711,528	79,879		11,515	3,892	295			1	3	93	
46,547,986	34,249,006	52,801		8,267	3,910	245					94	
5,656,634	31,844,443	44,831		12,836	159	139		1,149		13	95	
	22,673,000	14,058		3,543	132	(j)	(j)	33	1	2	96	
1,075,063	21,346,259	38,346		8,758	2,184	46				4	97	
5,860,600	0	0		0	0	0		0	0	1	98	
3,349,556	20,393,773	26,893		(k)	(k) 10,944	89		972		2	99	
10,171,610	9,773,216	19,809		3,132	782	4					100	
4,380,221	24,777,349	25,352		10,126	1,828	197				1	101	
3,393,556	111,516,666	98,164		22,703	8,690	543			4	40	102	
											103	
2,476,420	15,865,056	15,355		4,769	902	143				3	104	
	47,500,746	69,460		11,985	8,147	23				7	105	
	80,995,968	80,452		22,623	5,430	522				23	106	
39,172,759	43,060,640	72,320		14,233	2,898	456				5	107	
19,098,996	62,166,683	45,495		14,054	3,459	218				11	108	
9,673,871	35,886,457	31,556		7,928	398	32			2	11	109	
7,354,841	30,845,297	50,618		10,707	3,165	71		(656)	3	2	110	
10,645,200	41,996,288	33,011		10,073	3,306	177	(L)	1,158	2		111	
31,394,925	42,341,562	32,851		16,791	(Q) 3,942	272		1,904		7	112	
840,278	36,613,500	49,160		10,172	270						113	
	22,747,913	56,666		7,183	2,447	232				2	114	
6,206,174	20,865,103	40,830		10,778	2,331	41		1,555	2	2	115	
4,812,465	214,025,515	49,837		11,707	3,550	825				16	116	
	129,532,123	86,648		12,439	3,890	204				12	117	
	58,099,755	35,969		6,073	2,397	42				6	118	

(j) Municipal service included with "other sales."

(k) Commercial light and small power combined with wholesale.

(l) Rural.

(m) Bills rendered in December.

(n) Electricity exchanged for water power.

(o) 40,000 kw. started December 26, 1929.

(p) Includes exchange 73,124,300 kw.-hr.

(q) Exchange.

(r) All energy sold at low tension bus of generating station.

(s) Includes current for exciters and auxiliaries 4,041,390 kw.-hr.

(t) Canadian Niagara Power Co., Ltd. (see Canada) included in Niagara-Hudson Power Corp. System. Latter comprises systems of Buffalo, Niagara & Eastern Power Corp., Mohawk Hudson Power Corp., Northeastern Power Corp., St. Lawrence Securities Co., St. Lawrence Power Co., Ltd. (Canada), Fulton Light, Heat & Power Co., and Peoples Gas & Electric Co. of Oswego.

(u) Includes New York Edison Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co., United Electric Light & Power Co., and Yonkers Electric Light & Power Co.

(v) Commercial light and small power, wholesale energy and other sales combined with residential service.

(w) Includes Metropolitan Edison Co., New Jersey Power & Light Co., Fleetwood & Kutztown Electric Light, Heat & Power Co., Maryland Public Service Co., and Bangor (Pa.) Electric Co.

(x) Includes the properties formerly known as Binghamton Light, Heat & Power Co. and Lockport Light, Heat & Power Co.

(y) Kw.-hr. transferred from associated companies.

(z) Commercial light and small power, wholesale energy and municipal service combined with residential service.

(A) Interchange

(B) Does not include 34,000 kw. capacity purchased from Super Power Co. or 60,000 kw. allotted capacity in State Line Generating Co.

(C) Covers the period July 1 to December 31.

(D) Of this the output of the interconnected part of the system is 104,299,041 kw.-hr.

(E) Includes 1,718,757 kw.-hr., 4,590 customers, rural.

(F) Kva.

(G) Includes leased plants or parts of plants.

(H) Company sells at wholesale only. No segregated classification.

(I) Also 231,575 kw. available by lease or contract.

(J) Includes 1,259,417 kw.-hr., 804 custo-

248,400	1,611,521,000	1,582,693,000	28,828,000	30,162,023	29,941,030	1,177,425,879	16,943,227			138,210,861		
189,347	882,360,000	613,200,000	269,160,000	45,676,048	42,249,071	602,298,259	12,956,343			49,648,156		
										285,137,830		
	Totals for section			117	552,972	17	745,452	4,294,658,385	3,146,850,554	1,147,807,831		
	West South Central States											
102	Oklahoma Gas & Electric Company			30	160,775	0	0	692,070,936	606,426,649	85,644,287		3
103	Texas Electric Service Company			15	93,697	0	0	665,625,000	522,443,000	143,182,000		
104	Louisiana Power & Light Company			15	90,782	0	0	511,225,000	441,079,000	70,146,000		
105	Houston Lighting & Power Company			4	132,956	0	0	510,247,000	505,627,000	4,620,000		2
106	Texas Power & Light Company			22	65,388	3	340	442,818,000	301,388,000	141,430,000		3
107	New Orleans Public Service, Inc.			3	112,700	0	0	345,847,000	345,847,000	0		2
108	Arkansas Power & Light Company			48	41,894	2	9,666	310,955,000	65,731,000	245,224,000		1
109	Gulf States Utilities Company			11	82,008	(P) 15	(P) 2,179	273,182,834	268,381,134	4,801,700		1
110	Public Service Company of Oklahoma			14	65,245	0	0	255,220,126	225,018,659	30,201,467		2
111	West Texas Utilities Company			21	38,592	0	0	246,515,315	234,532,572	11,982,743		1
112	Central Power & Light Company			56	61,022	4	5,250	239,756,655	194,697,068	45,059,587		1
113	San Antonio Public Service Company			6	91,880	2	650	238,200,935	213,522,395	24,678,540		1
114	Dallas Power & Light Company			1	57,500	0	0	199,099,200	197,242,900	1,856,300		2
115	Southwestern Gas & Electric Company			17	46,578	0	0	149,696,794	130,122,314	19,574,480		1
	Totals for section			263	1,141,017	26	18,085	5,080,459,795	4,252,058,691	828,401,104		
	Mountain States											
116	The Montana Power Company			2	900	10	248,400	1,611,521,000	1,582,693,000	28,828,000		3
117	Utah Power & Light Company			4	42,540	41	189,347	882,360,000	613,200,000	269,160,000		4
118	Idaho Power Company			0	0	8	71,500	471,732,000	451,093,000	20,639,000		3
119	Public Service Company of Colorado			11	86,900	8	33,600	319,607,394	316,525,735	3,081,659		3
120	Salt River Valley Water Users' Association			0	0	7	59,650	188,665,617	151,815,395	36,850,222	(I)	
	Totals for section			17	130,340	74	602,497	3,473,886,011	3,115,327,130	358,558,881		
	Pacific States											
121	Southern California Edison Company			3	324,750	25	420,570	3,162,988,030	3,149,936,277	13,051,753		13
122	Pacific Gas & Electric Company			8	182,300	33	494,250	2,717,874,472	2,072,030,212	645,844,260		27
123	The North American Company System (California Group)			8	118,400	13	295,105	1,692,113,398	1,573,864,416	118,248,982		3
124	Puget Sound Power & Light Company			7	72,000	14	150,735	941,992,205	791,546,829	150,445,376		12
125	The Washington Water Power Company			0	0	9	188,310	858,353,000	854,833,000	3,520,000		7
126	City of Los Angeles, Bureau of Power and Light			0	0	5	96,605	722,998,796	255,642,800	467,355,996		8
127	Portland Electric Power Company			3	55,000	6	81,980	603,423,300	596,589,400	6,833,900		5
128	Hetch Hetchy Water Supply, City & County of San Francisco			0	0	2	83,000	464,339,110	464,338,110	1,000		
129	The California Oregon Power Company			2	340	11	88,568	410,083,711	400,987,271	9,096,440		3
130	City of Seattle, Light and Power Department			1	35,000	2	132,000	364,959,930	350,351,230	14,608,700		8
131	Los Angeles Gas & Electric Corporation			2	148,700	0	0	304,100,629	304,071,409	29,220	(S)	16
132	The Nevada-California Electric Corporation System (U)			2	8,335	11	58,575	300,320,585	223,763,560	76,557,025	(V)	1
133	Northwestern Electric Company			2	42,500	1	12,000	286,529,056	232,623,109	53,905,947		2
134	City of Tacoma, Light Division, Dept. Pub. Util.			1	9,000	2	64,000	255,771,531	217,080,098	38,691,433		3
135	Pacific Power & Light Company			5	11,350	15	35,916	251,759,000	189,132,000	62,627,000		4
136	San Diego Consolidated Gas & Electric Company			2	72,800	0	0	185,639,011	181,283,200	4,355,811		2
137	Mountain States Power Company and Subsidiaries			21	21,157	8	6,270	112,617,618	42,534,091	70,083,527		2
	Totals for section			67	1,101,632	157	2,207,884	13,635,863,382	11,900,607,012	1,735,256,370		
	Canada											
138	Hydro Electric Power Commission of Ontario			0	0	32	(F) 821,391	5,071,853,732	4,356,816,109	715,037,623		
139	The Shawinigan Water & Power Company			0	0	8	534,990	3,726,436,341	(X) 3,073,415,273	653,021,068		
140	Duke-Price Power Company, Ltd.			0	0	1	(F) 363,000	2,093,829,000	2,093,829,000	0		
141	Canadian Hydro-Electric Corporation, Ltd. System			0	0	20	466,000	2,090,788,460	2,088,895,509	1,892,951		
142	Montreal Light, Heat & Power Consolidated			1	16,500	4	215,410	1,568,864,226	1,042,881,170	525,983,056		
143	Winnipeg Electric Company (Y)			1	12,000	2	151,000	703,982,200	703,982,200	0		5
144	Canadian Niagara Power Company, Ltd.			0	0	1	75,000	632,261,900	632,261,900			
145	West Kootenay Power & Light Company, Ltd.			0	0	3	123,000	539,626,687	539,626,687	0		(
146	City of Winnipeg Hydro-Electric System			0	0	1	(F) 97,750	445 579,835	402,425,400	43,154,435		14
147	British Columbia Electric Railway Company, Ltd.			1	(F) 12,500	4	(F) 123,325	418,075,320	414,416,000	3,659,320		4
148	Canada Northern Power Corporation, Ltd. System			0	0	8	98,840	347,797,680	347,797,680	0		
149	Dominion Power & Transmission Company, Ltd.			1	20,000	1	37,500	249,785,300	190,747,300	59,038,000		
150	Southern Canada Power Company, Ltd.			0	0	5	44,210	149,105,920	143,504,320	5,601,600	(S)	1
151	Calgary Power Company, Ltd.			8	(aa) 18,000	3	(aa) 68,000	126,876,336	123,319,023	3,557,313		
	Totals for Canada			12	70,500	93	2,915,350	18,164,862,937	16,153,917,571	2,010,945,366		
	Mexico											
152	The Mexican Light & Power Company, Ltd. and Subsidiaries			2	(bb) 32,240	12	132,016	641,828,127	641,828,127	0		1
153	Cia Agricola y de Fuerza Electrica del Rio Conchos, S.A.			0	0	2	28,000	141,967,487	141,967,487	0		
154	The Guanajuato Power & Electric Company			0	0	3	18,600	107,111,000	33,149,000	73,962,000		
155	Puebla Tramway, Light & Power Company			0	0	4	27,900	104,808,000	104,808,000	0		
	Totals for Mexico			2	32,240	21	206,516	995,714,614	921,752,614	73,962,000		
	Electric Railways and Electrified Railroads											
156	Interborough Rapid Transit Company			2	390,000	0	0	1,217,047,463	1,216,972,000	75,463		
157	Chicago Surface Lines			0	0	0	0	664,908,358	0	664,908,358		
158	Williamsburgh Power Plant Corporation (B.M.T.)			2	204,100	0	0	599,442,974	599,442,974	0		
159	Philadelphia Rapid Transit Company			1	(cc)	0	0	384,076,148	35,589,025	348,487,123		
160	The Pennsylvania Railroad (L. I. City Gen. Sta.)			1	87,500	0	0	343,646,828	296,257,550	47,389,278		
161	The New York Central Railroad Company			2	110,000	0	0	247,599,220	196,514,510	51,084,710		
162	Boston Elevated Railway			5	182,000	0	0	247,473,090	247,473,090	0		
163	The New York, New Haven & Hartford Railroad Company			1	(F) 62,840	0	0	209,370,023	130,258,075	79,111,948		
164	Pacific Electric Railway Company			0	0	0	0	182,813,761	0	182,813,761		
165	Chicago, Milwaukee, St. Paul & Pacific Railroad Company			0	0	0	0	156,186,340	0	156,186,340		
166	Twin City Rapid Transit Company			1	75,000	2	16,000	140,190,412	83,217,330	56,973,082		
167	Norfolk & Western Railway Company			8	44,665	0	0	134,368,264	104,246,891	30,121,373		
168	Kansas City Public Service Company			0	0	0	0	132,202,720	0	132,202,720		
169	The Connecticut Company			1	22,500	1	700	120,427,038	51,271,130	69,155,908		
170	The Virginian Railway Company			1	(F) 50,000	0	0	109,970,000	109,970,000	0		
	Totals for Railways and Railroads			25	1,206,037	3	16,700	4,889,722,639	3,071,212,575	1,818,510,064		

861	4,812,465	214,025,515	49,837	11,707	3,550	825	.....	.....	16	116		
156	.....	129,532,123	86,648	12,439	3,890	204	.....	.....	12	117		
830		58,099,755	35,969	6,073	2,397	42	.....	.....	6	118		

(J) Includes 1,259,417 kw.-hr., 804 custo-

39,150,310	48,418,333	430,204,719	18,103,575	.....	22,128,973	19,154,804	3,393,556	111,516,666	98,164	22,703	8
4,360,958	4,374,642	144,798,523	2,968,829	.....	.....	336,380,572	2,476,420	15,865,056	15,355	4,769	
28,976,059	21,693,658	316,494,702	23,841,351	.....	.....	71,740,484	.....	47,500,746	69,460	11,985	8
33,439,424	23,072,781	238,384,746	24,698,371	.....	.....	42,226,710	.....	80,995,968	80,452	22,623	5
29,918,466	28,614,032	121,716,863	14,290,041	.....	.....	69,074,199	39,172,759	43,060,640	72,320	14,233	2
16,177,671	22,195,438	152,486,509	9,785,540	.....	.....	29,044,163	19,098,996	62,166,683	45,495	14,054	3
12,873,124	22,672,213	174,284,763	4,786,387	.....	4,191,954	8,814,065	9,673,871	35,886,457	31,556	7,928	
21,165,113	21,141,118	99,940,147	3,939,693	1,078,328	5,859,869	63,895,720	7,354,841	30,845,297	50,618	10,707	3
18,066,843	19,997,522	103,733,859	4,519,627	(I) 963,340	293,970	46,298,666	10,645,200	41,996,288	33,011	10,073	3
11,295,732	16,596,630	(Q) 124,584,397	6,968,902	3,605,977	.....	2,968,530	31,394,925	42,341,562	32,851	16,791	(Q) 3
18,032,895	55,042,530	41,506,641	3,601,855	.....	11,768,560	70,794,676	840,278	36,613,500	49,160	10,172	
26,252,083	29,906,683	72,477,577	13,595,648	.....	.....	34,119,296	.....	22,747,913	56,666	7,183	2
13,535,422	22,792,166	63,554,012	7,203,642	2,497,968	7,717,259	5,325,048	6,206,174	20,865,103	40,830	10,778	2
30,162,023	29,941,030	1,177,425,879	16,943,227	.....	.....	138,210,861	4,812,465	214,025,515	49,837	11,707	3
45,676,048	42,249,071	602,298,259	12,956,343	.....	.....	49,648,156	.....	129,532,123	86,648	12,439	3
36,187,086	16,889,145	72,666,002	2,752,182	.....	.....	285,137,830	.....	58,099,755	35,969	6,073	2
38,566,484	49,178,696	131,723,382	8,015,672	.....	514,114	22,040,265	3,463,463	66,105,318	100,445	15,988	6
2,733,563	0	86,064,673	10,545,100	0	0	14,161,119	39,822,353	35,338,809	(I) 2,926	0	
134,728,809	96,923,961	811,009,965	111,253,106	528,206,833	305,430,075	600,154,699	7,200,256	568,080,326	341,073	43,617	16
276,440,948	577,084,203	433,935,551	40,839,826	(R) 230,041,491	282,841,956	107,472,473	72,890,569	696,327,455	446,362	85,306	
39,344,338	119,986,388	954,965,051	6,607,453	53,202,744	29,074,771	36,306,399	7,571,786	445,054,468	94,514	25,109	25
122,405,218	167,535,143	325,643,922	5,005,588	.....	50,890,194	13,561,464	42,181,524	214,769,152	120,919	19,600	1
77,910,988	44,226,140	303,960,890	16,576,776	.....	.....	255,589,541	330,302	159,758,363	43,399	7,208	3
87,180,141	257,555,535	214,647,000	.....	52,796,591	.....	.....	11,478,249	99,339,280	208,642	46,233	2
59,429,300	53,548,492	218,576,926	21,144,871	21,030,158	12,397,972	39,019,565	62,793,069	115,482,947	89,762	8,491	2
0	0	0	0	0	0	413,652,000	13,363,130	37,323,980	0	0	
30,788,858	13,879,849	69,380,226	1,593,992	.....	.....	223,291,537	3,289,064	67,860,185	18,773	3,973	1
84,250,115	(k)	(k) 130,681,069	16,768,273	.....	38,718,292	19,432,000	10,729,685	64,380,496	82,824	(k)	(k) 12
162,606,262	(S, T)	(T) 89,232,097	2,036,703	.....	0	0	4,815,496	45,410,071	(f, S) 150,220	(S, T)	(f, T) 8
11,977,961	(V, W)	(W) 180,486,598	5,324,538	.....	.....	15,334,995	2,266,877	84,929,616	(V) 19,913	(V, W)	(W) 8
25,161,490	23,654,742	192,069,403	3,386,979	.....	.....	2,379,900	.....	39,876,542	23,786	4,463	1
37,260,644	31,904,868	114,609,286	13,932,300	.....	1,213,203	20,060,928	8,733,437	28,056,865	32,002	3,826	2
43,645,568	20,689,721	92,715,614	4,788,961	.....	.....	37,083,584	868,268	51,967,284	49,063	10,333	4
27,409,761	28,614,155	63,463,074	5,521,224	.....	16,882,000	8,380,892	7,382,426	27,985,479	54,873	10,917	4
25,192,603	12,889,806	40,620,395	2,918,264	.....	.....	5,877,225	2,070,607	23,048,718	37,110	8,745	2
		3,460,531,057	.....	.....	.....	.....	14,167,368	251,737,916	.....	.....	
0	0	1,499,820,986	1,312,581	0	0	590,328,167	.....	2,367,266	0	0	
.....	.....	.....	14,315,000	.....	141,192,143	34,470,028	.....	.....	231,172	5,867	.....
59,753,052	18,381,092	367,589,000	42,873,716	49,839,321	47,162,105	24,192,986	.....	94,190,928	.....	.....	.....
(d)	(d) 4,288,828	485,312,806	4,242,933	.....	.....	.....	.....	45,782,020	(d)	(d) 2,970	
146,038,869	71,170,801	46,731,832	13,480,479	(Z) 90,165,300	.....	5,298,400	.....	72,694,154	39,031	7,563	1
46,749,943	44,983,052	140,015,067	11,585,951	20,000,000	79,567,903	359,850	6,086,378	68,727,176	67,267	12,627	2
2,305,880	3,832,326	293,516,119	638,871	4,270,599	.....	.....	.....	43,233,885	7,979	1,929	
.....	.....	.....	.....	.....	.....	.....	.....	.....	9,000	3,300	
14,621,700	(S, T)	(T) 58,179,420	2,256,800	.....	.....	68,988,000	.....	5,060,000	(S) 24,914	(S, T)	(T)
.....	.....	.....	.....	.....	.....	.....	.....	.....	(d) 12,494	(d)	
17,218,904	38,305,734	288,038,980	40,122,601	16,078,276	79,113,289	.....	7,669,657	155,280,686	98,808	35,903	
23,207	.....	131,744,329	.....	.....	.....	7,532,434	837,081	1,830,436	104	.....	
18,650	6,638	22,099,217	5,257	.....	.....	67,710,389	.....	17,270,849	143	47	
1,472,539	1,850,164	47,727,873	4,802,362	.....	.....	14,186,960	12,839,000	21,930,000	8,159	3,379	

Summary of Generator Rating and Output

Section	Number of Companies or Systems	Number of Generating Plants and Generator Ratings — All Plants — No.	All Plants — Rating, Kw.	Fuel Plants — No.	Fuel Plants — Rating, Kw.	Hydro Plants — No.	Hydro Plants — Rating, Kw.	Energy Generated, Kw.-Hr.	Energ Purchas Kw.-H
United States	**137**	**1,740**	**25,911,781**	**984**	**18,821,157**	**756**	**7,090,624**	**81,561,345,767**	**13,169,89**
New England	12	85	1,836,639	29	1,456,910	56	379,725	4,833,969,766	945,18
Middle Atlantic (t)	22	292	7,117,414	134	5,597,622	158	1,519,792	23,248,037,098	2,841,95
East North Central	31	301	6,167,787	179	5,916,076	122	251,711	18,955,836,552	3,909,16
West North Central	11	135	1,743,142	81	1,368,945	54	374,197	5,211,980,139	72,64
South Atlantic	14	189	2,546,924	97	1,555,643	92	991,281	6,896,678,825	1,330,91
East South Central	11	134	1,298,424	117	552,972	17	745,452	3,146,850,554	1,147,80
West South Central	14	289	1,159,102	263	1,141,017	26	18,085	4,252,058,691	828,40
Mountain	5	91	732,837	17	130,340	74	602,497	3,115,327,130	358,55
Pacific	17	224	3,309,516	67	1,101,632	157	2,207,884	11,900,607,012	1,735,25
Canada	**14**	**105**	**2,985,850**	**12**	**70,500**	**93**	**2,915,350**	**16,153,917,571**	**2,010,94**
Mexico	**4**	**23**	**238,756**	**2**	**32,240**	**21**	**206,516**	**921,752,614**	**73,96**
Railways and Railroads	**15**	**28**	**1,222,737**	**25**	**1,206,037**	**3**	**16,700**	**3,071,212,575**	**1,818,5**

(C) Covers the period July 1 to Decem-

	0	103,748,759	2,816,157	100,932,602								
	745,452	4,294,658,385	3,146,850,554	1,147,807,831								
	0	692,070,936	606,426,649	85,644,287	39,150,310	48,418,333	430,204,719	18,103,575		22,128,973	19,154,804
	0	665,625,000	522,443,000	143,182,000							
	0	511,225,000	441,079,000	70,146,000	4,360,958	4,374,642	144,798,523	2,968,829			336,380,572
	0	510,247,000	505,627,000	4,620,000	28,976,059	21,693,658	316,494,702	23,841,351			71,740,484
	340	442,818,000	301,388,000	141,430,000	33,439,424	23,072,781	238,384,746	24,698,371			42,226,710
	0	345,847,000	345,847,000	0	29,918,466	28,614,032	121,716,863	14,290,041			69,074,199
	9,666	310,955,000	65,731,000	245,224,000	16,177,671	22,195,438	152,486,509	9,785,540			29,044,163
(P)	2,179	273,182,834	268,381,134	4,801,700	12,873,124	22,672,213	174,284,763	4,786,387		4,191,954	8,814,065
	0	255,220,126	225,018,659	30,201,467	21,165,113	21,141,118	99,940,147	3,939,693	1,078,328	5,859,869	63,895,720
	0	246,515,315	234,532,572	11,982,743	18,066,843	19,997,522	103,733,859	4,519,627	(l) 963,340	293,970	46,298,666
	5,250	239,756,655	194,697,068	45,059,587	11,295,732	16,596,630	(Q) 124,584,397	6,968,902	3,605,977		2,968,530
	650	238,200,935	213,522,395	24,678,540	18,032,895	55,042,530	41,506,641	3,601,855		11,768,560	70,794,676
	0	199,099,200	197,242,900	1,856,300	26,252,083	29,906,683	72,477,577	13,595,648			34,119,296
	0	149,696,794	130,122,314	19,574,480	13,535,422	22,792,166	63,554,012	7,203,642	2,497,968	7,717,259	5,325,048
	18,085	5,080,459,795	4,252,058,691	828,401,104							
	248,400	1,611,521,000	1,582,693,000	28,828,000	30,162,023	29,941,030	1,177,425,879	16,943,227			138,210,861
	189,347	882,360,000	613,200,000	269,160,000	45,676,048	42,249,071	602,298,259	12,956,343			49,648,156
	71,500	471,732,000	451,093,000	20,639,000	36,187,086	16,889,145	72,666,002	2,752,182			285,137,830
	33,600	319,607,394	316,525,735	3,081,659	38,566,484	49,178,696	131,723,382	8,015,672		514,114	22,040,265
	59,650	188,665,617	151,815,395	36,850,222	(l) 2,733,563	0	86,064,673	10,545,100	0	0	14,161,119
	602,497	3,473,886,011	3,115,327,130	358,558,881							
	420,570	3,162,988,030	3,149,936,277	13,051,753	134,728,809	96,923,961	811,009,965	111,253,106	528,206,833	305,430,075	600,154,699
	494,250	2,717,874,472	2,072,030,212	645,844,260	276,440,948	577,084,203	433,935,551	40,839,826	(R) 230,041,491	282,841,956	107,472,473
	295,105	1,692,113,398	1,573,864,416	118,248,982	39,344,338	119,986,388	954,965,051	6,607,453	53,202,744	29,074,771	36,306,399
	150,735	941,992,205	791,546,829	150,445,376	122,405,218	167,535,143	325,643,922	5,005,588		50,890,194	13,561,464
	188,310	858,353,000	854,833,000	3,520,000	77,910,988	44,226,140	303,960,890	16,576,776			255,589,541
	96,605	722,998,796	255,642,800	467,355,996	87,180,141	257,555,535	214,647,000		52,796,591		
	81,980	603,423,300	596,589,400	6,833,900	59,429,300	53,548,492	218,576,926	21,144,871	21,030,158	12,397,972	39,019,565
	83,000	464,339,110	464,338,110	1,000	0	0	0	0	0	0	413,652,000
	88,568	410,083,711	400,987,271	9,096,440	30,788,858	13,879,849	69,380,226	1,593,992			223,291,537
	132,000	364,959,930	350,351,230	14,608,700	84,250,115	(k)	(k) 130,681,069	16,768,273		38,718,292	19,432,000
	0	304,100,629	304,071,409	29,220	(S) 162,606,262	(S, T)	(T) 89,232,097	2,036,703		0	0
	58,575	300,320,585	223,763,560	76,557,025	(V) 11,977,961	(V, W)	(W) 180,486,598	5,324,538			15,334,995
	12,000	286,529,056	232,623,109	53,905,947	25,161,490	23,654,742	192,069,403	3,386,979			2,379,900
	64,000	255,771,531	217,080,098	38,691,433	37,260,644	31,904,868	114,609,286	13,932,300		1,213,203	20,060,928
	35,916	251,759,000	189,132,000	62,627,000	43,645,568	20,689,721	92,715,614	4,788,961			37,083,584
	0	185,639,011	181,283,200	4,355,811	27,409,761	28,614,155	63,463,074	5,521,224		16,882,000	8,380,892
	6,270	112,617,618	42,534,091	70,083,527	25,192,603	12,889,806	40,620,395	2,918,264			5,877,225
	2,207,884	13,635,863,382	11,900,607,012	1,735,256,370							
(F)	821,391	5,071,853,732	4,356,816,109	715,037,623							
	534,990	3,726,436,341	(X) 3,073,415,273	653,021,068			3,460,531,057				
(F)	363,000	2,093,829,000	2,093,829,000	0	0	0	1,499,820,986	1,312,581	0	0	590,328,167
	466,000	2,090,788,460	2,088,895,509	1,892,951							
	215,410	1,568,864,226	1,042,881,170	525,983,056				14,315,000		141,192,143	34,470,028
	151,000	703,982,200	703,982,200	0	59,753,052	18,381,092	367,589,000	42,873,716	49,839,321	47,162,105	24,192,986
	75,000	632,261,900	632,261,900								
	123,000	539,626,687	539,626,687	0	(d)	(d) 4,288,828	485,312,806	4,242,933			
(F)	97,750	445 579,835	402,425,400	43,154,435	146,038,869	71,170,801	46,731,832	13,480,479	(Z) 90,165,300		5,298,400
(F)	123,325	418,075,320	414,416,000	3,659,320	46,749,943	44,983,052	140,015,067	11,585,951	20,000,000	79,567,903	359,850
	98,840	347,797,680	347,797,680	0	2,305,880	3,832,326	293,516,119	638,871	4,270,599		
	37,500	249,785,300	190,747,300	59,038,000							
	44,210	149,105,920	143,504,320	5,601,600	(S) 14,621,700	(S, T)	(T) 58,179,420	2,256,800			68,988,000
(aa)	68,000	126,876,336	123,319,023	3,557,313							
	2,915,350	18,164,862,937	16,153,917,571	2,010,945,366							
	132,016	641,828,127	641,828,127	0	17,218,904	38,305,734	288,038,980	40,122,601	16,078,276	79,113,289	
	28,000	141,967,487	141,967,487	0	23,207		131,744,329				7,532,434
	18,600	107,111,000	33,149,000	73,962,000	18,650	6,638	22,099,217	5,257			67,710,389
	27,900	104,808,000	104,808,000	0	1,472,539	1,850,164	47,727,873	4,802,362			14,186,960
	206,516	995,714,614	921,752,614	73,962,000							
	0	1,217,047,463	1,216,972,000	75,463							
	0	664,908,358	0	664,908,358							
	0	599,442,974	599,442,974	0							
	0	384,076,148	35,589,025	348,487,123							
	0	343,646,828	296,257,550	47,389,278							
	0	247,599,220	196,514,510	51,084,710							
	0	247,473,090	247,473,090	0							
	0	209,370,023	130,258,075	79,111,948							
	0	182,813,761	0	182,813,761							
	0	156,186,340	0	156,186,340							
	16,000	140,190,412	83,217,330	56,973,082							
	0	134,368,264	104,246,891	30,121,373							
	0	132,202,720	0	132,202,720							
	700	120,427.038	51,271,130	69,155,908							
	0	109,970,000	109,970,000	0							
	16,700	4,889,722,639	3,071,212,575	1,818,510,064							

Summary of Gener

Section	Number of Companies or Systems	Number of Gener — All Plants — No.	Rating, Kw.
United States	**137**	**1,740**	**25,911,781**
New England	12	85	1,836,639
Middle Atlantic (t)	22	292	7,117,414
East North Central	31	301	6,167,787
West North Central	11	135	1,743,142
South Atlantic	14	189	2,546,924
East South Central	11	134	1,298,424
West South Central	14	289	1,159,102
Mountain	5	91	732,837
Pacific	17	224	3,309,516
Canada	**14**	**105**	**2,985,850**
Mexico	**4**	**23**	**238,756**
Railways and Railroads	**15**	**28**	**1,222,737**

804	3,393,556	111,516,666	98,164	22,703	8,690	543	.....	4	40	102
										103
572	2,476,420	15,865,056	15,355	4,769	902	143	.....	.....	3	104
484	.....	47,500,746	69,460	11,985	8,147	23	.....	.....	7	105
710	.....	80,995,968	80,452	22,623	5,430	522	.....	.....	23	106
199	39,172,759	43,060,640	72,320	14,233	2,898	456	.....	.....	5	107
163	19,098,996	62,166,683	45,495	14,054	3,459	218	.....	.....	11	108
065	9,673,871	35,886,457	31,556	7,928	398	32	.....	2	11	109
720	7,354,841	30,845,297	50,618	10,707	3,165	71	(656)	3	2	110
666	10,645,200	41,996,288	33,011	10,073	3,306	177	(L) 1,158	2	.....	111
530	31,394,925	42,341,562	32,851	16,791	(Q) 3,942	272	1,904	.....	7	112
676	840,278	36,613,500	49,160	10,172	270	.....	.....	.....	.....	113
296	.....	22,747,913	56,666	7,183	2,447	232	.....	.....	2	114
048	6,206,174	20,865,103	40,830	10,778	2,331	41	1,555	2	2	115
861	4,812,465	214,025,515	49,837	11,707	3,550	825	.....	.....	16	116
156	.....	129,532,123	86,648	12,439	3,890	204	.....	.....	12	117
830	.....	58,099,755	35,969	6,073	2,397	42	.....	.....	6	118
265	3,463,463	66,105,318	100,445	15,988	6,138	61	.....	1	11	119
119	39,822,353	35,338,809	(I) 2,926	0	218	15	0	0	1	120
699	7,200,256	568,080,326	341,073	43,617	16,350	2,719	36,280	5	11	121
473	72,890,569	696,327,455	446,362	85,306	78	313	(R) 17,726	14	17	122
399	7,571,786	445,054,468	94,514	25,109	25,963	186	13,833	11	10	123
464	42,181,524	214,769,152	120,919	19,600	1,065	137	.....	2	12	124
541	330,302	159,758,363	43,399	7,208	3,109	276	.....	.....	30	125
...	11,478,249	99,339,280	208,642	46,233	2,340	.....	.....	.....	.....	126
565	62,793,069	115,482,947	89,762	8,491	2,837	482	135	10	9	127
000	13,363,130	37,323,980	0	0	0	0	0	0	1	128
537	3,289,064	67,860,185	18,773	3,973	1,001	66	.....	.....	7	129
000	10,729,685	64,380,496	82,824	(k)	(k) 12,252	1	.....	1	1	130
0	4,815,496	45,410,071	(f, S) 150,220	(S, T)	(f, T) 8,681	(f) 171	.....	0	0	131
995	2,266,877	84,929,616	(V) 19,913	(V, W)	(W) 8,197	102	.....	.....	10	132
900	.....	39,876,542	23,786	4,463	1,212	57	.....	.....	.....	133
928	8,733,437	28,056,865	32,002	3,826	2,277	117	.....	1	14	134
584	868,268	51,967,284	49,063	10,333	4,034	141	.....	.....	5	135
892	7,382,426	27,985,479	54,873	10,917	4,380	22	.....	1	3	136
225	2,070,607	23,048,718	37,110	8,745	2,809	74	.....	.....	10	137
										138
	14,167,368	251,737,916	.....	.....	.....	.....	.....	.....	.....	139
167	.....	2,367,266	0	0	4	1	0	0	2	140
										141
028	.....	.....	231,172	5,867	.....	.....	.....	1	17	142
986	.....	94,190,928	.....	.....	.....	.....	.....	.....	.....	143
	.....	.....	.....	.....	.....	.....	.....	.....	.....	144
	.....	45,782,020	(d)	(d) 2,970	7	14	.....	.....	.....	145
400	.....	72,694,154	39,031	7,563	1,256	7	(Z) 1	.....	2	146
850	6,086,378	68,727,176	67,267	12,627	2,516	.....	.....	.....	.....	147
	.....	43,233,885	7,979	1,929	56	14	986	.....	.....	148
	.....	.....	9,000	3,300	600	10	.....	3	.....	149
000	.....	5,060,000	(S) 24,914	(S, T)	(T) 511	114	.....	.....	4	150
	.....	.....	(d) 12,494	(d)	8	.....	.....	.....	.....	151
	7,669,657	155,280,686	98,808	35,903	263	960	15,216	1	.....	152
434	837,081	1,830,436	104	.....	15	.....	.....	.....	2	153
389	.....	17,270,849	143	47	54	2	.....	.....	25	154
960	12,839,000	21,930,000	8,159	3,379	354	69	.....	.....	2	155

(C) Covers the period July 1 to December 31.

(D) Of this the output of the interconnected part of the system is 104,299,041 kw.-hr.

(E) Includes 1,718,757 kw.-hr., 4,590 customers, rural.

(F) Kva.

(G) Includes leased plants or parts of plants.

(H) Company sells at wholesale only. No segregated classification.

(I) Also 231,575 kw. available by lease or contract.

(J) Includes 1,259,417 kw.-hr., 804 customers, rural.

(K) Also 1,303 kw. available by lease or contract.

(L) Also 300 kw. available by lease or contract.

(M) Municipal, electric railway and other public utilities combined with wholesale.

(N) Also 211,380 kw. available by lease or contract.

(O) Also 24,595 kw. available by lease or contract.

(P) Oil engine stations.

(Q) Includes rural.

(R) Agriculture.

(S) Residential service and commercial light combined.

(T) Wholesale energy and small power combined.

(U) Includes The Nevada-California Power Co., The Southern Sierras Power Co., and Yuma Utilities Co.

(V) Includes heating and possibly some commercial light and heat. Company's classification differs from that in this table.

(W) Wholesale and retail light, heat and power included under wholesale energy.

(X) Includes 307,894,583 kw.-hr. hydraulic water power sold.

(Y) Includes Manitoba Power Co., Ltd.

(Z) Off-peak.

(aa) Horsepower.

(bb) Standby.

(cc) Leased to Philadelphia Electric Co., Oct. 1, 1929.

enerator Rating and Output

Generating Plants and Generator Ratings— Fuel Plants— No.	Fuel Plants— Rating, Kw.	Hydro Plants No.	Hydro Plants Rating, Kw.	Energy Generated, Kw.-Hr.	Energy Purchased, Kw.-Hr.	Total Energy Output, Kw.-Hr.
984	**18,821,157**	**756**	**7,090,624**	**81,561,345,767**	**13,169,894,613**	**94,731,240,380**
29	1,456,910	56	379,725	4,833,969,766	945,189,308	5,779,159,074
134	5,597,622	158	1,519,792	23,248,037,098	2,841,955,215	26,089,992,313
179	5,916,076	122	251,711	18,955,836,552	3,909,161,014	22,864,997,566
81	1,368,945	54	374,197	5,211,980,139	72,649,369	5,284,629,508
97	1,555,643	92	991,281	6,896,678,825	1,330,915,521	8,227,594,346
117	552,972	17	745,452	3,146,850,554	1,147,807,831	4,294,658,385
263	1,141,017	26	18,085	4,252,058,691	828,401,104	5,080,459,795
17	130,340	74	602,497	3,115,327,130	358,558,881	3,473,886,011
67	1,101,632	157	2,207,884	11,900,607,012	1,735,256,370	13,635,863,382
12	**70,500**	**93**	**2,915,350**	**16,153,917,571**	**2,010,945,366**	**18,164,862,937**
2	32,240	21	206,516	921,752,614	73,962,000	995,714,614
25	1,206,037	3	16,700	3,071,212,575	1,818,510,064	4,889,722,639